

# Chemical Week

April 16, 1955

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**Plasticizers will parallel plastics' growth; here's the broad picture, who's doing what . . . . .** p. 40

▶ **Spencer's Gull helps** salesmen to help dealers to persuade farmers to buy fertilizer . . . . . p. 60

**Target: a chemical nematocide to conquer Spreading Decline, Florida's citrus blight . . . .** p. 70

**Germicide makers cash in on a trend: 20% of U. S. toilet soap now contains such products . . .** p. 72

▶ **Carnegie Tech's Rossini heads** industry-sponsored project to correlate chemical data . . p. 101



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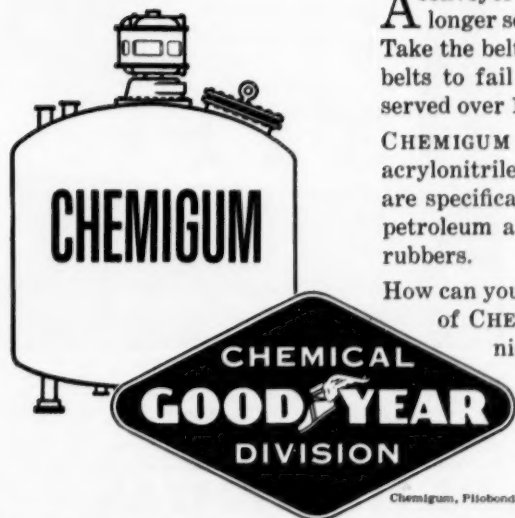
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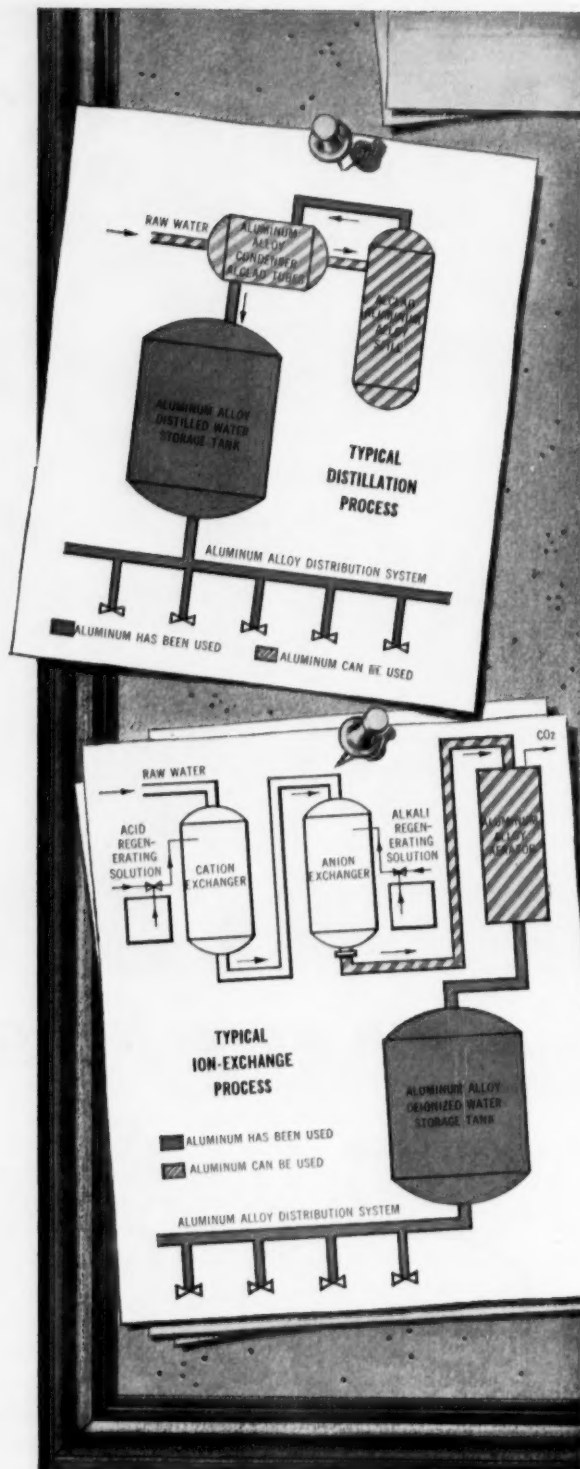
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Chemical Week • April 16, 1955

# Chemical Week

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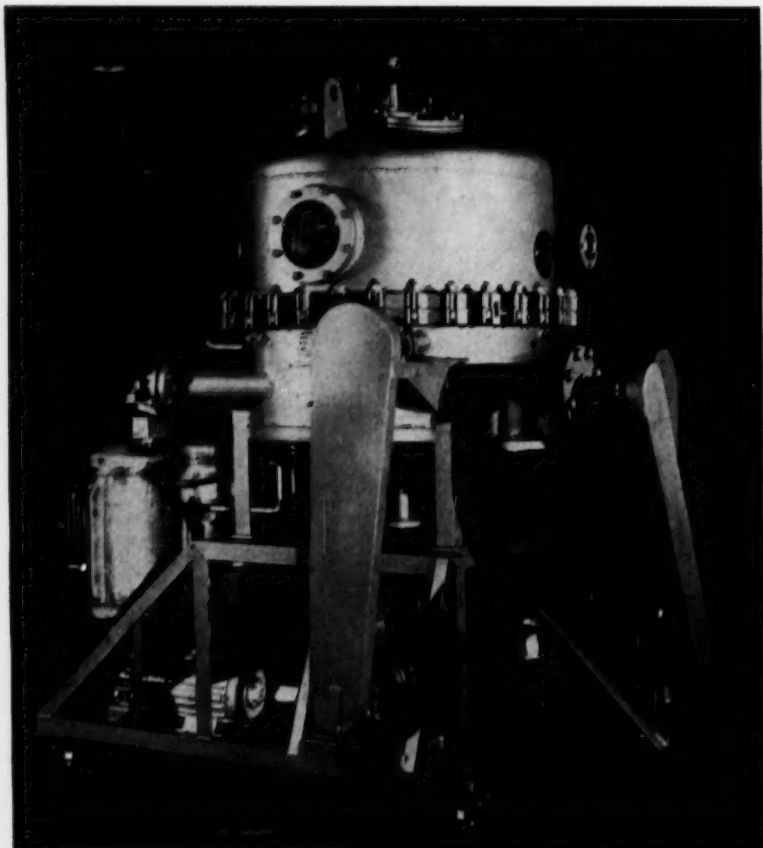
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MCA-sponsored chemical  
census. Goal: an almanac  
of accurate, up-to-date data



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## OPINION.....

### Note With Awe

TO THE EDITOR: While I hate to mention this, is it possible that your decimal point is showing? In a recent issue I noted with awe the stated Jordan Phosphate Co. plant capacity of 200 million tons per year—almost 10 times world phosphate rock production in 1951!

Based upon other data presented in this news item, I suspect that the proper figure is 200 million *pounds* per year or 100 thousand tons. This then would be perhaps consistent with the expected 1955 phosphate shipments from Jordan-Israel of 25,000 tons to Poland, and 15,000 tons to Czechoslovakia.

Phosphate fertilizer operations in Israel and Jordan, of course, have expanded tremendously over the last few years. I hope I am correct in assuming that Near East phosphate will not be engulfing our U.S. phosphate operations—at least not yet . . .

J. R. LOFSTROM  
Supervisor

Technical Economics Dept.  
Research Division  
International Minerals &  
Chemical Corp.  
Chicago

*Looks as if we blundered. Our dispatch cited "tons" but we are now rechecking our correspondent to have the figures rechecked. Odds are that Reader Lofstrom is dead right.—Ed.*

### Who's Kidding Whom?

TO THE EDITOR: Mr. Reuther's recent statement in Cleveland draws the bargaining issues fairly clearly. He contends that as long as science and technology make it possible for industry to produce more, labor will continue to ask for "more and more."

This statement plainly recognizes that increased productivity is due to science and technology; yet he does not advocate any benefits to promote

CW welcomes expressions of opinion from readers. The only requirements: that they be pertinent, as brief as possible.

Address all correspondence to:  
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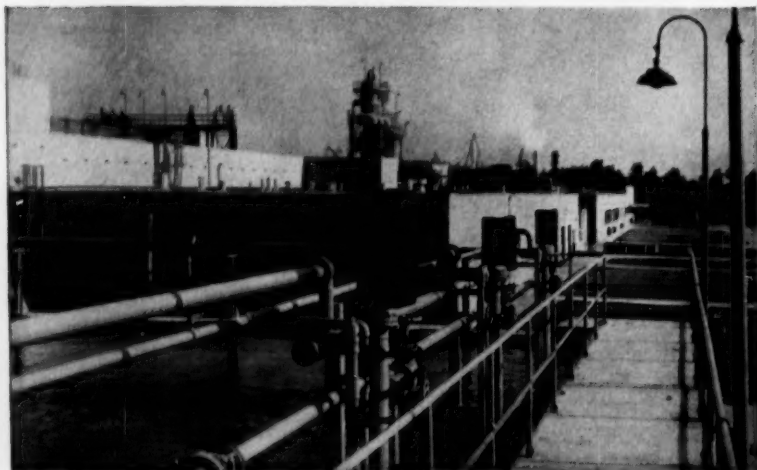
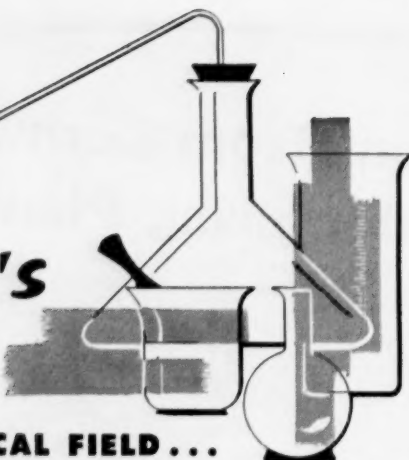
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## OPINION . . . . .

science and technology in the form of grants to universities or higher wages for grossly underpaid college instructors and professors. Instead, unfortunately he says, labor will continue to ask for "more and more."

Careful consideration of this phenomenon called "American Productivity" will show that there is a delicate balance between three groups: Top Management, Labor, and Scientific Staff. Lack of cooperation or failure to function properly by any one of the three results in loss of productivity . . .

The last few years . . . has seen a relatively stable balance between the three groups. However, the increasing discussion about guaranteed annual wage has done much to disturb the balance . . . It has begun to inject no small amount of the "boom and bust" psychology back into our economy. This is borne out by the fact that the steel industry has increased activity from 65 to 95% of capacity . . . to get a large enough backlog to "ride out" a possible prolonged strike over the issue of GAW.

Who is kidding whom? The labor leaders, in order to capture the imagination of the rank and file of union members, coined GAW. It sounds like a big deal. However, careful consideration will show that what is needed is a factual, realistic approach to the problem—an approach that would consider steps to even out the peaks and valleys of production. This could be done on a cooperative basis between the three groups and would stand a greater chance of bearing fruit than the threatened strikes over GAW.

This discussion should also include the scientists and technologists, whom Mr. Reuther conveniently chooses to overlook. This group is normally identified with management, and it is not tightly organized for bargaining purposes . . .

Mr. Reuther's statement about "more and more" because of science and technology possibly could have far-reaching repercussions, because the representatives of science and technology will be carefully watching, while labor's efforts are concentrated to grab "more and more and more."

It might be like killing the goose that laid the golden egg. . . .

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Chicago, Ill.

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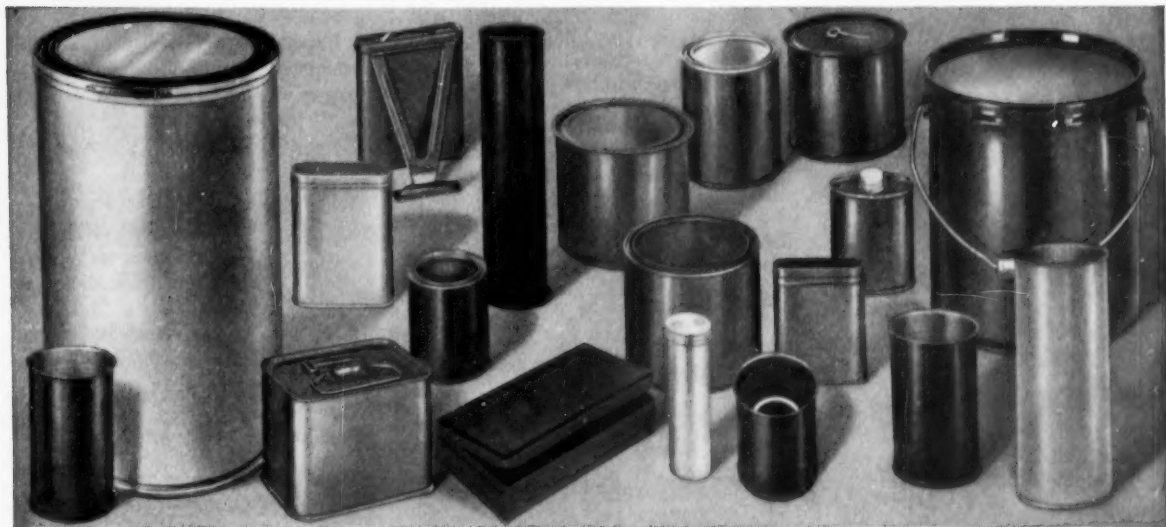
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## OPINION . . . . .

### Rocket Propellants

TO THE EDITOR: We emphatically concur with CW's general conclusions in the interesting "Target" describing the large market for chemicals in the rocket field (*March 26, p. 48*). As one of the organizations actively engaged in development of new and improved propellants and rockets, we must keep up with all the topics you have mentioned . . .

Two additional points of information seem important enough to us to occasion this letter. We wonder if you didn't confuse us with Atlantic Refining in your listing "propellant probing firms." (If you did, you are in distinguished company: the similarity of names has led many others to think we are affiliated with or part of Atlantic Refining, whereas we are a completely independent contract consulting research company.)

The second point pertains to your comments on propellants. Your readers should certainly be made to appreciate the fact that solid propellants, such as those used in JATO units and many missiles, are at least as large a market as the liquid propellants for the chemical process industries. The chemical systems that are of propellant interest are at least as wide in composition range as the liquids.

DEWITT O. MYATT  
Manager of Development  
Atlantic Research Corp.  
Alexandria, Va.

*Right. We did lump both liquid and solid propellants; we fumbled, however, in mentioning Atlantic Refining rather than unrelated Atlantic Research.—Ed.*

## DATES AHEAD . . .

The American Oil Chemists' Society annual meeting, Roosevelt Hotel, New Orleans, April 18-20.

The American Society of Mechanical Engineers, spring meeting, Lord Baltimore Hotel, Baltimore, Md., April 18-21.

American Zinc Institute, annual meeting, Drake Hotel, Chicago, April 23-29.

Scientific Apparatus Makers Assn., annual meeting, The Greenbrier, White Sulphur Springs, W.Va., April 24-28.

Chlorine Institute, spring meeting and golf tournament, Seaview Country Club, Absecon, N.J., April 26-27.

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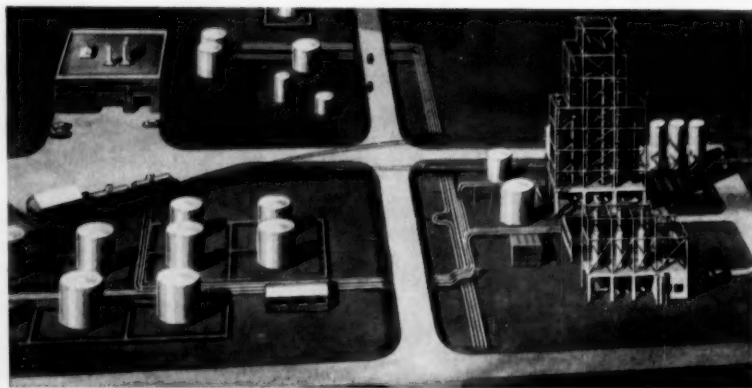
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## LUMMUS TO BUILD AIR REDUCTION CHEMICAL'S VINYL ACETATE PLANT AT CALVERT CITY, KENTUCKY

### Lummus-Built Plant To Come On Stream In Early 1956

The 30,000,000 lb. per year vinyl acetate plant which The Lummus Company is engineering and constructing for Air Reduction Chemical Company, a division of Air Reduction Company, Inc., is a good example of how industry can set up an integrated plant in a strategic location, and insure maximum returns for its capital investment. The plant's attractive location at Calvert City, Kentucky has all the benefits of readily available power, natural gas, water transportation, and a host of related chemical products.

This \$3,000,000 installation scheduled for completion early in 1956, is adjacent to the calcium carbide and acetylene plant of Air Reduction's National Carbide Division, and will receive pipeline acetylene from it. The new vinyl acetate plant will be a key develop-



ment in Air Reduction's chemical expansion which begins with basic raw materials and ends with a variety of products having important commercial and industrial uses.

Vinyl acetate goes principally into polyvinyl acetate emulsions, used in adhesives, latex paints and textile finishes, and polyvinyl alcohol used for adhesives and textile finishes.

At Calvert City, in addition to this new Air Reduction plant, Lummus is also building a \$6,000,000 high pressure acety-

lene derivatives plant for General Aniline & Film Corporation. What better example could be given to show that Lummus is ready, willing and able to design, engineer and construct your next chemical plant.

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## NEWSLETTER

In an atmosphere of clearing economic weather, chemical stocks—largely neglected by stock buyers since the first of the year—were leading the market into higher ground this week. Reason: strong first-quarter earning statements (*see Newsletter, April 2*) and a rash of proposed (or on the verge of proposed) stock splits.

Latest to propose a two-for-one split of its common stock: Cutter Laboratories—which would give one share of common voting stock and another share with limited voting privileges for each share of common now outstanding. Reason: need for more equity capital.

Poised right on the brink of proposing a two-for-one split: Rayonier Corp., reported to be toying with the possibility of merger with Eastern Corp. Should a deal be consummated, Rayonier would need additional common shares in order to effect share-for-share trading.

Search for commercial uses for boron nitride continues this week. The Carborundum Co. (Refractories Division) is turning out small quantities of the material at its Research and Development Division headquarters at Niagara Falls, N. Y.; but Carborundum has not decided to produce commercially, as yet. Material now offered is hot-pressed, may be used up to 1600° C for most applications. Uses being explored: rocket nozzles and combustion chamber linings, equipment for handling molten glass, high-temperature bushings, structural materials for atomic reactors, electric insulators and separators in vacuum tubes.

Pacific Northwest power consumers have their fingers crossed about the supply of cheap hydroelectric kilowatt-hours the region's Columbia River may be able to store up this summer in basin reservoirs for next fall and winter.

Some 10 of Bonneville Power Administration's 14 industrial customers are now buying marginal energy because BPA—in the face of the lowest stream flows of March record—is still curtailing (after previous deeper cuts—*CW, April 9, p. 38*) interruptible power deliveries to 75% of needs. But availability of higher-cost steam-power replacement (turned down by four of BPA's customers) is no encouragement in the face of continued drawdown of storage pools—at a time when they should be filling up.

Should the spring be late and the summer cool—the region could squeak through. But if the spring is early (and warm) the already-below-normal snowpack on the basin mountains will surge seaward.

This could cause a crisis.

You can't afford to miss your competitors' television programs these days. Judging from a complaint filed late last week in federal district court at New York, people from Coty, Inc. are among the most intent viewers of TV programs sponsored by Revlon Products Corp.

In its civil suit, Coty charges that a Revlon lipstick commercial included the lines "and you wake up just as beautiful with the same live color on your lips." Coty says this is an infringement of "Wake up beauti-

ful," Coty's companion trademark to "24" for its long-wearing lipstick (*CW*, April 9, p. 97). Furthermore, Coty asserts that Revlon adopted the new advertising pitch without changing its product.

What Coty wants: an injunction against use of "long-wearing" claims "until such shall be truthful representations" and against trademark infringement, plus actual damages, costs and attorney's fees.

•  
A trial this summer without a jury is shaping up for the four Utah salt producers recently indicted for alleged restraint of trade and price-fixing (*CW*, March 26, p. 15).

As expected, the Dept. of Justice filed the formal charges last week in federal district court at Salt Lake City, and the salt companies pleaded "not guilty."

When the companies' lawyers said they would need some time to prepare their defense, Judge Sherman Christenson asked if they wanted to have the case placed on the calendar for the October jury term. The lawyers thought this over, then decided to ask for nonjury trial about July.

•  
Will a cleavage pop up within the CIO's new Oil, Chemical & Atomic Workers union? The possibility is seen in the union's current wage drive, with oil locals getting increases in the neighborhood of around 10¢/hour and chemical locals signing contract renewals with lesser gains.

This possible cause for interlocal resentment has just been spotlighted in three contracts going into effect this week in the San Francisco Bay area. OCAW unions at Shell Oil (Martinez) and Shell Chemical (West Pittsburg) are getting a flat 10¢ boost; and locals at Standard Oil (Richmond) and Associated Oil (Avon) were expected to accept a 4½% rise that would amount to about 10¢/hour; but the Hercules Powder local at Hercules, Calif., has signed up for a 7% pay hike.

•  
Ominous rumblings of brewing trouble are being heard in the South this week, too. Congressman Robinson (D., Ky.) is being deluged with letters and wires from industries along the struck Louisville & Nashville Railroad lines urging federal action to start the trains rolling.

Among those asking for relief: Federal Chemical, North American Fertilizer, Glidden Varnish.

Fertilizer producers are in their big season now—and where they're exclusively dependent on the L&N at production point, the strike is hitting hard at company sales. One ray of hope: though the strike's in its fifth week now, with no prospect of early agreement, workers are getting hungry, have shown their irritation at the railroad's tenacity by dynamiting some sections of the track. And that—if it continues—is one sure way to elicit federal interference.

•  
The Weather Bureau—which has puzzled over some corks in its time—is working overtime on this one: a well-known Midwest chemical company wants to know if there's any spot in the country where it can be assured of dust storms this summer. Reason for the seemingly nonsensical request: the company is studying an antisoiling compound for rugs, wants to test its new product under the worst possible conditions.





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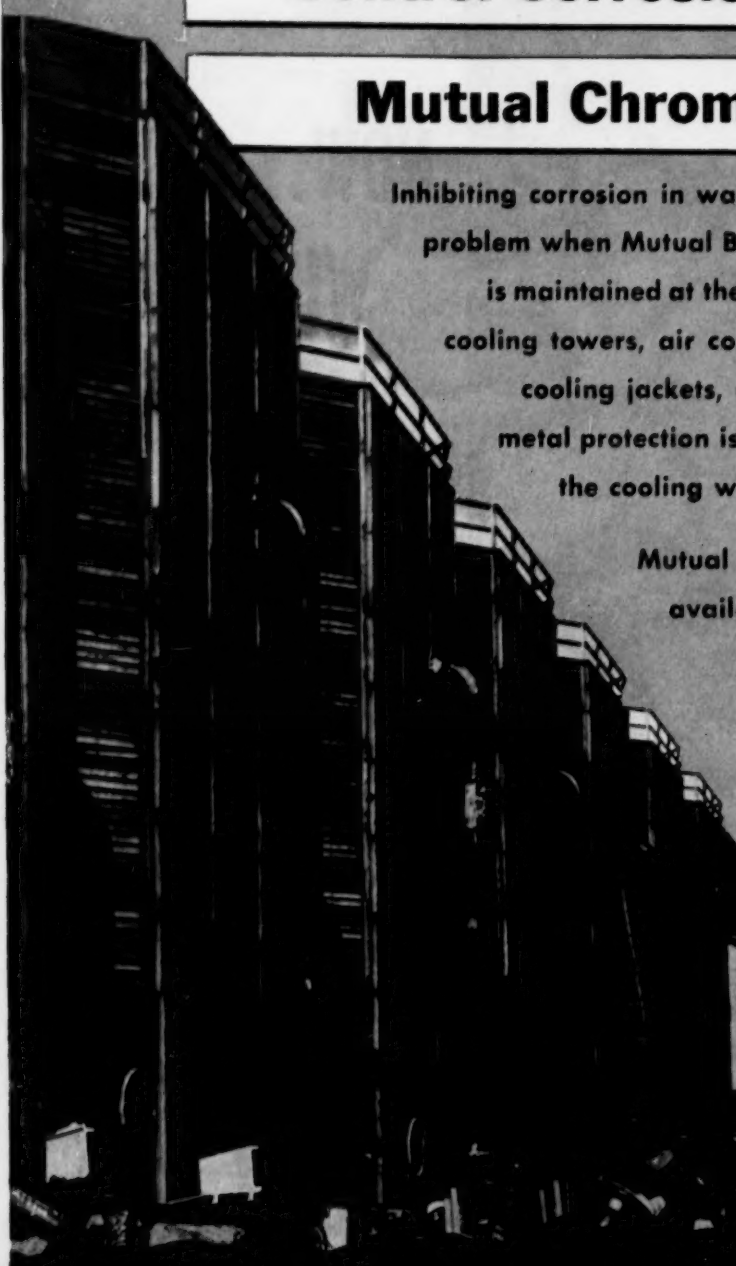


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# BUSINESS & INDUSTRY . . . .



PRIEST, RICHARDS: Traffic cops of House committees that will guide . . .

## Dispute over Alien Property

Lobbyists for German corporate interests have come up with a new legislative tactic that may delay settlement of the dispute over alien property return.

As a result, settlement of seized asset claims on the basis of the Administration plan (*CW, Feb. 19, p. 14*) looks further away than ever. The Administration would return asset claims of up to \$10,000 to individuals only—corporations could not collect.

Under the tentative decisions arrived at by top Administration officials, such property as General Aniline & Film would not be returned. However, those fearing return of property to the Germans have felt all along that such an Administration "compromise" would eventually open the door to complete restoration either of the property or of cash equivalent of all seized assets.

The new maneuvers indicate that congressmen favorable to the German position are planning a strategy to get more than the Administration would allow.

**Purpose Revealed:** Their idea is to

have different committees handle the legislation this year. The change allows the whole subject of asset return to be taken up by a Congressional committee that German interests hope will be more sympathetic to their pleas.

**Coming Up:** To understand the legislative infighting that will take place this year and next over alien property, it's important to know which bills will be coming up before what committee. These are the bills:

- Now at the Budget Bureau for final clearance is the draft of legislation embodying the position of the Eisenhower Cabinet. This bill draft would allow return to "natural persons" of amounts up to \$10,000, as well as trademarks and copyrights. The Administration is also believed to support amending Section 9A, so as to allow sale of GAF by the government.

- The Kilgore-Dirksen bill (S. 995) provides for return of all seized property to the person or corporation from which it was vested. However, if the President finds it to be in the best

interests of the United States not to give foreigners such control, he may order them to sell out to U.S. citizens within a year. This bill is similar to the one introduced by Dirksen last year, though it does not include 1954's Kilgore amendment, which would have barred return of assets to persons or corporations that employed slave labor.

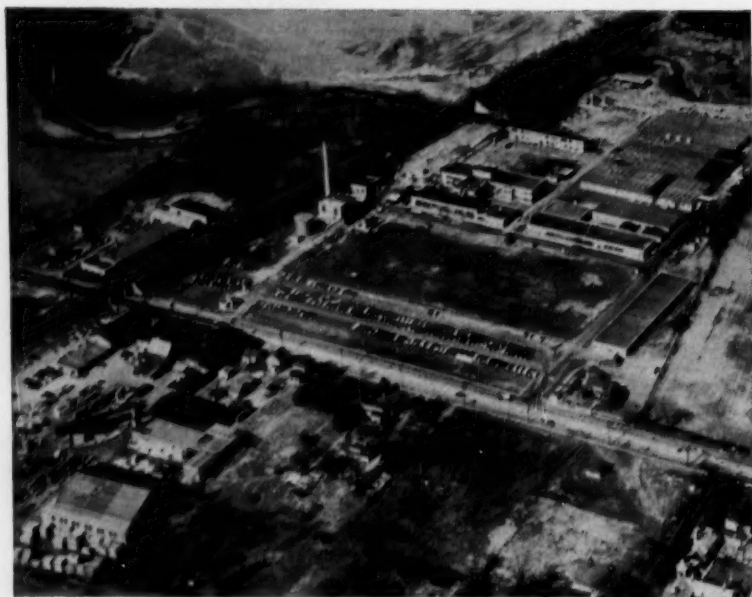
- The Clements bill (S. 1405) would amend Section 9A of the Trading with the Enemy Act to allow sale or liquidation of property involved in litigation. The law suit would be continued over the sale proceeds.

- Newest entries (*CW Newsletter, April 9*) are four resolutions (H.J. Res. 264, 265, 268 and 272) introduced by Democrats Morgan (Pennsylvania), Pilcher (Georgia), Rivers (South Carolina) and Hays (Arkansas). These identical measures would give back to the Germans the money value of the vested properties. They were introduced after the Administration determined its position on alien property (*CW, Feb. 19, p. 14*)—a position unsatisfactory to some German interests.

The Washington law firm of Boykin and DeFrancis is pushing action on these resolutions, as agent for the Studiengesellschaft für Privatrechtliche Auslandsinteressen, an organization of many German corporations whose property was seized.

Washington observers are speculating that the resolutions were introduced more as a delaying action, in hope of postponing final asset disposal until some future date when the international climate is such that Congress would not only quickly approve the principle of asset return, but also would pass enabling legislation and a money bill.

For now, however, the resolutions may delay enactment of other legislation—of which the about-to-be-introduced Administration proposal has the best chance of eventual passage. But complications now in sight mean that "eventually" may be far removed from "now."



**BLOOMFIELD PLANT SITE:** After a doleful start, Schering seems poised on the brink of a . . .

## Possibly Potent Future

Notice of Schering Corp.'s birth as a 100% publicly owned company in 1952 was as indifferent an event as the chemical industry has ever seen. Its prospectus was steeped in caution; no one was willing—or even rash enough—to predict that the company would more than limp along as an “also-ran” in the highly competitive drug industry.

It appears, however, that Schering may have stolen an important march on the rest of the industry through the development (CW, March 19, p. 70) of two steroid hormones for the treatment of rheumatoid arthritis—Metacortandralone and Metacortandracin. Clinical findings indicate that both are considerably more effective than cortisone, hydrocortisone and ACTH. Result: menacing growls are starting to be heard from the corporate throats of Merck and Pfizer.

**Doleful Start:** Vested by the Alien Property Custodian in 1942 under the provisions of the 1917 Trading with the Enemy Act, the Attorney General auctioned the company off in 1952 to the highest bidder—the syndicate of 72 brokers headed by Merrill Lynch, Pierce, Fenner and Beane. Split 4 for 1, the stock was sold publicly for \$17.50/share.

At that time, sales were \$15.6 mil-

lion—broken down into ethical sales, 69%; bulk sales, 6%; proprietary sales, 5%; cosmetic sales, 2%; and export sales, 18%.

Sales haven't risen much (to \$19.4 million in 1954)—but the product mix has changed significantly. And this may be the key to where Schering is heading.

Of 1951 ethical sales (\$10.8 million), 39% was derived from sale of hormones, 26% from sale of antihistamines, 16% from sale of such chemotherapeutic agents as sulfonamide and penicillin formulations.

Now, however, best estimates indicate that antihistamines account for about 60% of domestic sales (still predominantly ethical)—and close to 90% of total net income.

Moreover, Schering's feat in the antihistamine field is noteworthy not only because it has bailed out the hormone division in recent years, but also because of the extent to which the company has become an increasingly important factor in the field.

This could assume added significance in view of the recent steps in the legal hassle with the Attorney General over the validity of the Jan. 5, 1952, patent directive against Schering (CW, April 2, p. 15). Since the company's gains are not based

solely on increasingly successful promotion of its older technology covered by the patent directive, an adverse ruling would mean merely that Schering would have to grant reasonable nonexclusive licenses on its basic antihistamines—not the subsequent modifications of know-how.

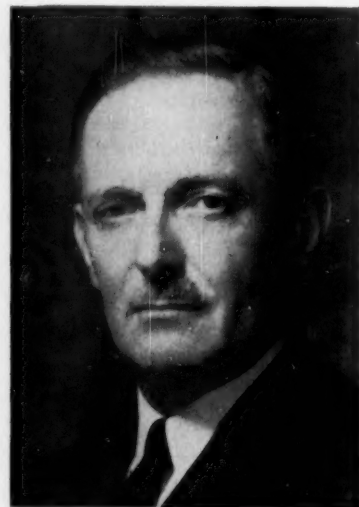
**Anti-Arthritics Will Help:** There's little promise that sex hormones will immediately start carrying their weight earnings-wise, but with its two new anti-arthritic drugs, Schering needn't be too concerned.

The potential market for anti-arthritics lies in a range of some \$35-50 million annually, and Schering is currently obtaining only a small share of the junior-size actual market—a market that has seen steady price weakness.

Should the “meta” drugs fulfill their promise, Schering will occupy not only a materially more important position, but also (if its patent applications hold water) a dominant position in the steroid market.

There's no way of telling which way the Patent Office will jump—or when, nor what Schering will do if the decision is favorable. In view of the limited size of its distribution organization, chances favor cross-licensing arrangements, with Merck and Pfizer.

On the sidelines, however some 15,000 stockholders are avidly rooting for their fledgling company—possibly none so fervently as Schering's 72 syndicated foster parents—who have waited three years for signs that their foster child would show signs of growing up.



**BROWN:** Predicts a further sales rise.





WIDE WORLD

**SEN. KUCHEL:** On bill for air pollution research, backing from AMA.

## Two-Bill Hearing

More research, and possibly more enforcement—that's the outlook as of this week for the federal government's activities in air and stream pollution for the coming fiscal year.

Details of these proposed programs will be analyzed at a hearing set for the week of April 25 before a Senate Public Works subcommittee; and it's likely that chemical industry spokesmen will drop in to comment on at least one aspect of the two bills to be considered. Those bills:

- The Administration's bill to extend the Water Pollution Control Act (CW, March 19, p. 22).
- A bill introduced by California's Senator Tom Kuchel that would broaden that act to provide for air pollution research.

Kuchel's bill—cosponsored by three other Republican senators—has been endorsed by the American Medical Assn., whose board of trustees has voted "active approval." It probably will get further support at the hearing from the federal government's inter-agency committee on air pollution; officials are expected to present their estimates on funds needed for research, both by the federal government and in grants to states and communities.

Little opposition is foreseen on either bill's main features. About the only controversial point will be a move to broaden enforcement powers on interstate water pollution.

## Rebuffed, Re-elected

After having scolded both sides in the dispute between some 2,300 members of United Mine Workers and Wyandotte Chemical Co., William Kreger has been re-elected as mayor of Wyandotte, Mich., where the strike—now in its tenth week—has aroused considerable civic displeasure.

Terming the situation "a spectacle of self-destruction," Kreger voiced a demand that Wyandotte and UMW Local 12270 "stop fruitless talking and act at once to end this crisis." He said the company should immediately make its best offer to the union, and that the union should submit that offer to its members via secret ballot.

Both sides in effect told Kreger to keep out of their affair; but last week, Wyandotte did make a new offer, with controversial clauses reworded, and the union did take a vote on it. Result: the offer was rejected. No further negotiations were scheduled.

## Old Acid, New Duty

If your company's intermediates are coming into the U.S. at duty rates that you think are too high, there's a new chance to get those rates lowered: see if you can't make those chemicals from a low-duty raw material.

That seems to be the moral to be drawn from the recent triumph of Standard Oil Co. (N.J.) in the U. S. Court of Customs & Patent Appeals at Washington. As a result of this victory, Esso will now be able to bring naphthenic acid into this country duty-free.

In past years, this product came from coal, and a 25% ad valorem duty was assessed on all naphthenic imported into the U.S. Esso, however, deals with naphthenic that's obtained from petroleum; and the company saw no reason why this naphthenic shouldn't be admitted duty-free under the "petroleum distillates" section of the tariff laws.

The Customs Bureau couldn't see it that way, so Esso took its case into the Customs Court at New York, won a decision there. The government refused to give up, asked the Court of Customs & Patent Appeals to reverse the decision. After an interval of more than a year, the upper court last fortnight handed down its finding: Esso wins.



WIDE WORLD

**JUDGE HOLTZOFF:** On wage rates, a setback for nationwide decrees.

## All U.S.: No 'Locality'

For at least the next six or eight months, the Walsh-Healey minimum wage rates in chemical and other industries will remain in effect (CW, March 5, p. 12); whether those rates have any longer life expectancy will be up to the U.S. Supreme Court, or possibly the Congress.

What has happened to jolt the outlook for those wage rates is the victory by some 158 Southern manufacturers of cotton and rayon in federal district court at Washington. At their behest, Judge Alexander Holtzoff—the judge who sentenced ex-Rep. J. Parnell Thomas and tax-fixer Henry Grunewald—ruled that Secretary of Labor James Mitchell has no power to set Walsh-Healey wage rates on an industry-wide basis.

Mitchell—who, like his Democratic predecessors, feels that the Walsh-Healey Public Contracts Act should be used to help jack up Southern wages toward the Northern level—says he'll appeal to the Supreme Court.

**Phrase at Issue:** Judge Holtzoff tended to agree that his decision might prevent the Walsh-Healey law from being used for the purpose for which it was enacted (to keep low-wage manufacturers from underbidding union-scale shops on government contracts). But, he emphasized, that's a matter to be decided by Congress.

Crux of the dispute is a phrase in the law authorizing the Secretary of

Labor to set minimum wage rates determined "by the prevailing minimum wages for persons employed on similar work or in the particular or similar industries or groups of industries currently operating in the locality in which the materials" are to be manufactured.

The Labor Dept. has never taken the word "locality" too seriously; in nine chemical industry categories, for example, the Walsh-Healey rates have been set on a nationwide basis. Holtzoff did not rule on just how big an area can be included within one "locality," but he declared that it would be a "tortured" interpretation to say that the entire U.S. is just a single locality.

## COMPANIES. . . .

**Kaiser Aluminum & Chemical Corp.** directors have voted a three-for-one split of the company's common stock, subject to stockholder approval of an increase in authorized common shares. The split is also subject to approval of the California Corporation Commissioner.

Stockholders will vote on the increase (from 6 million to 20 million shares) at a special meeting May 24; the split would be effective May 31.

Reported earnings for the company's third fiscal quarter (ending Feb. 28): \$7.4 million—compared with \$2.9 million for the corresponding period a year ago.

**Minnesota Mining & Mfg. Co.** has formed a chemical products group to coordinate research, production and sales efforts of the company's chemical products.

**International Smelting & Refining Co.** will reopen its lead smelter in Tooele, Utah, some time next month. Reason: mining activities in the park city area, some 40 miles east of Salt Lake City, are such that operation of the smelter has become feasible. International's lead-zinc reduction and zinc fuming plants at Tooele are already operating—stock-piling materials for the smelter that closed last year because of depressed lead-zinc prices.

**W. R. Grace & Co.** plans to sell publicly up to \$30 million of 20-year convertible subordinated debentures next month. A special meeting of stock-

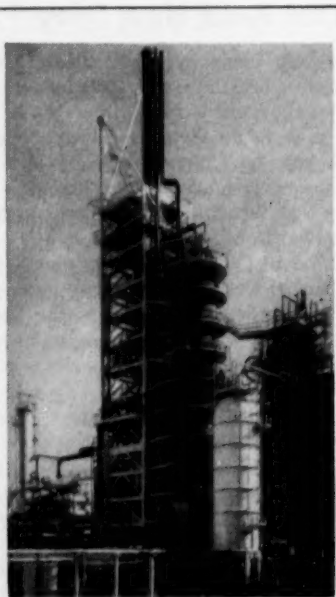
holders will be called on May 10 to authorize additional shares of common stock into which the debentures will be convertible. Statement with SEC will be filed before the end of April.

**The Niobium Corp.** has been formed to reclaim strategic metals (including cobalt, nickel and columbium) from stainless steel scrap. Company headquarters will be in New York City.

**Green Belt Chemical Co.** has been incorporated in Cincinnati, O., listing capital stock of \$200,000. The new firm plans to build a commercial fertilizer plant "somewhere in northern Ohio," will locate home offices in Cincinnati.

## EXPANSION. . . .

**Ammonia:** Westvaco Chlor-Alkali Division's new ammonia units at South Charleston, W. Va., will go into pro-



### 18-Story Hydroformer

**ESSO STANDARD OIL CO.'s** new liquid fluid hydroformer, which the firm claims to be the world's largest, is now onstream at Baton Rouge, La. Over 18 stories high, the hydroformer reportedly will produce up to 25,000 bbls./day of high-octane gasoline.

duction sometime this fall. Cost of construction: \$2.5 million.

**Chlorine, Caustic Soda:** Union Chemical & Materials Corp. will expend \$8 million to increase facilities of its two subsidiaries—Frontier Chemical Co. (Wichita, Kan.) and Consumers Co. (Chicago).

Close to \$6 million will be spent to double Frontier's chlorine and caustic soda capacity and to build a chlorinated solvents plant. The \$2 million for Consumers Co. will be used chiefly for a \$1.3-million gravel plant.

**Sulfate Pulp:** North Western Pulp and Power Co. will start construction late this spring on a \$33-million bleached sulfate pulp mill in Alberta, Canada. Daily capacity: 400 tons—up 100 tons from that originally planned. North Western is jointly owned by St. Regis Paper Co. and Northern Canadian Oils.

**Petroleum Catalysts:** Davison Chemical Co., division of W. R. Grace & Co., will build a \$4-million petroleum cracking catalyst plant at Curtis Bay, Maryland to replace current units.

Earlier in the year, the company made known its plans to build a \$6-million catalyst plant at Valleyfield, Que., to serve the Canadian market.

Construction at Curtis Bay starts immediately; completion is expected early in 1956.

**Fiberboard:** Armstrong Cork Co. will expand its Macon, Ga., plant—doubling present capacity. Construction starts this summer with completion expected within a year.

**Paper:** Prospect of a \$50-million paper mill at Sioux Lookout, Ont., was noted in the Legislature last week by the Hon. Clare Mapledorum.

The Anglo Newfoundland Development Corp. has been granted a license to survey the Lac Seul Forest area for 18 months, and, if satisfied, will build its mill there. Anglo Newfoundland Development is controlled by the Rothmere interests, London, England.

**Phthalonitrile:** Barrett Division, Allied Chemical & Dye Corp., will initiate semicommercial production of phthalonitrile in the U.S. Facilities now under construction will produce it in substantial development quantities.



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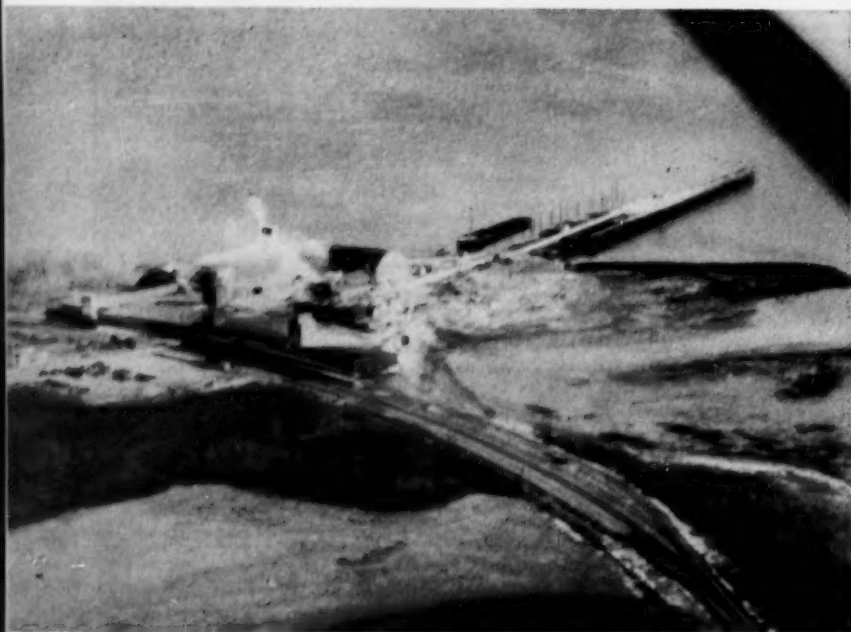
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SEARSPORT PLANT SITE: Added ammonia, nitric acid units will start Northern Chemical Industries . . .

## Climbing into Contention

First sulfuric acid, superphosphates, ammonium sulfate, and liquid alum; now ammonia and nitric acid facilities.

Reasoning behind NCI's diversification pattern: it's imperative to branch out in a business tied in with seasonal demand.

Like a particularly smooth-tasting whiskey, it often takes just the right blend of fortuitous circumstances to build a chemical plant. And that's largely the case with Northern Chemical Industries—the company that this week starts construction in Searsport, Maine, of its long-heralded \$9-million anhydrous ammonia plant.

Production of ammonia on Maine's "nitrogen island"\* had long been the dream of James E. Totman, determined NCI president. But until this year there's always been some detriment to construction—the heavy capital cost, lack of sufficient demand, or lack of borrowing power.

Now, however, spurred by the possibility of cutting costs (from an estimated \$15 million to \$9 million), thanks to the partial oxidation process developed by Texaco Development, and backed by \$5 million (raised

through issuance of 15-year 5½% subordinated debentures), the company is ready to go ahead.

Capacity: 125 tons of ammonia, 60 tons/day of nitric acid. Integrated output on a 350-day-year basis: 43,750 tons of ammonia—with 18,000 tons ticketed for use in production of 32,000 tons of nitrogen solutions.

**Four Cows/Acre:** Though NCI is shooting for the New England and Eastern Canadian market, executives admit they'll have to plug hard for an initial toehold with farmers. Competition will be Allied Chemical (with plants at Hopewell, Va., and Southpoint, O.), Olin Mathieson (at Morgantown, W. Va.), Du Pont (at Belle, W. Va.), and Atlantic Refining (at Philadelphia)—plus Sun Oil's proposed Marcus Hook anhydrous ammonia plant.

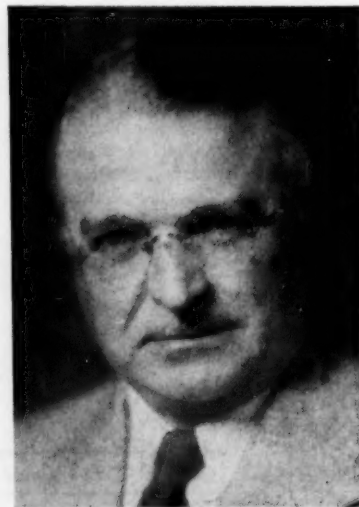
Freight rates should favor NCI, however. And as added insurance, NCI management has already

launched a program (buying nitrogen from its competitors) to educate Maine and northern New England farmers in the use of greater amounts per acre of fertilizer. Company slogan: for Maine, four cows per acre.

In the fertilizer year to June 30, '54, consumption in the New England area was 40,000 tons of ammonia (or equivalent; industrial users consumed an additional 19,500 tons, principally for sulfite pulping). Totman maintains that this is merely a starter, though; with proper encouragement, the annual take can be increased tremendously.

**Captive Market:** NCI has another initial advantage in selling its ammonia: Summers Fertilizer Co. (founded in 1922—and also controlled by Totman interests) has contracted to take 21,000 tons/year of ammonia (or equivalent) for five years after the NCI plant comes onstream early next year. This amounts to 48% of the plant's capacity—at which level of operations it should be on a break-even basis, with a cash throw-off depreciation and amortization of \$1.13 million—enough to cover the sinking fund requirements on the subordinated debentures and the semiannual payments of its senior debt (first mortgage notes).

With such prospects, Totman and his top-management team are predicting that company sales will top \$10 million by 1958, at which time the ammonia nitric acid facilities should



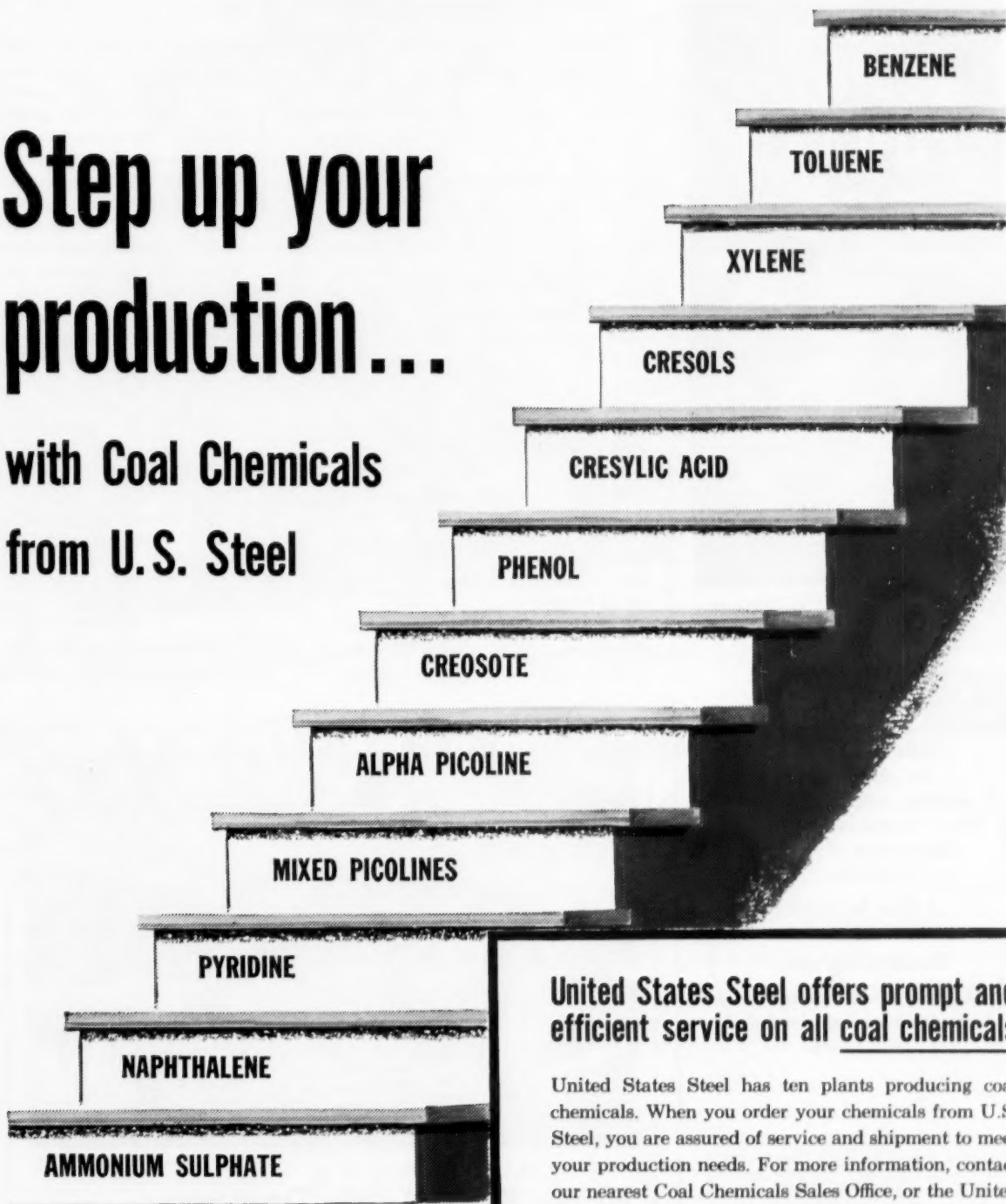
TOTMAN: Predicts \$10 million in sales by 1957.

\*So known in the fertilizer industry because of its relative inaccessibility.



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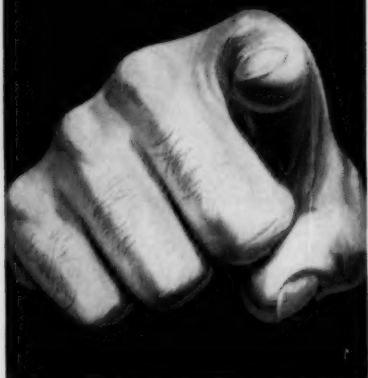
A NEW COLOR MOTION PICTURE, "The Waiting Harvest," tells an interesting story of U.S. Steel's participation in the field of chemicals. It is available on request in 16 or 35 mm film from Film Distribution Center, United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa. See "THE UNITED STATES STEEL HOUR"—Televised alternate weeks—Consult your newspaper for time and station.

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## BUSINESS & INDUSTRY . . . . .

be operating at full capacity. Last year (NCI's fiscal year ends July 31) sales totaled \$1.3 million—52% from sales of superphosphates, 31% from ammonium sulfate, 12% from liquid alum.

**More Sulfuric Acid Capacity:** Expansion plans aren't solely concerned with ammonia and nitric acid, either. NCI also will break ground shortly for additional sulfuric acid capacity, plans to have new units (approximately 40,000 tons/year) in operation by the first of 1956.

All plants will be built on land owned by NCI adjacent to its current facilities at Searsport. Location, Totman states, is another of the company's unusual natural advantages. Searsport's deep natural harbor will permit (1) economic handling of exports and imports, and (2) tankers carrying residual fuel oil (for use in ammonia-nitric acid production) to service company plants on a year-round basis.

**Exports Import:** According to latest estimates, NCI's reliance on export of end products to overseas consumers

isn't great—but is growing "at a satisfactory rate." Over 20% of the company's total superphosphate production is today shipped overseas—chiefly to the Far East and South America.

**Outlook for ammonia export sale:** some 15-20% of total output, once the plant is operating at full capacity.

Future of Northern Chemical Industries, however, still hinges on the Maine farmer. And this Totman and his associates frankly admit.

It hasn't been easy for the management of a "relatively small company to blow itself up from a million-dollar to a \$10-million firm, chiefly through funded debt—and still retain control." But NCI officials have succeeded—and they hope to be equally successful in selling their products to Maine's potato growers.

"We've been awaiting and planning this move for 25 years," one executive states. "In order to survive in an industry that is beset by seasonal demands, the small company must diversify."

That's what NCI is doing, now that the opportune moment has arrived.



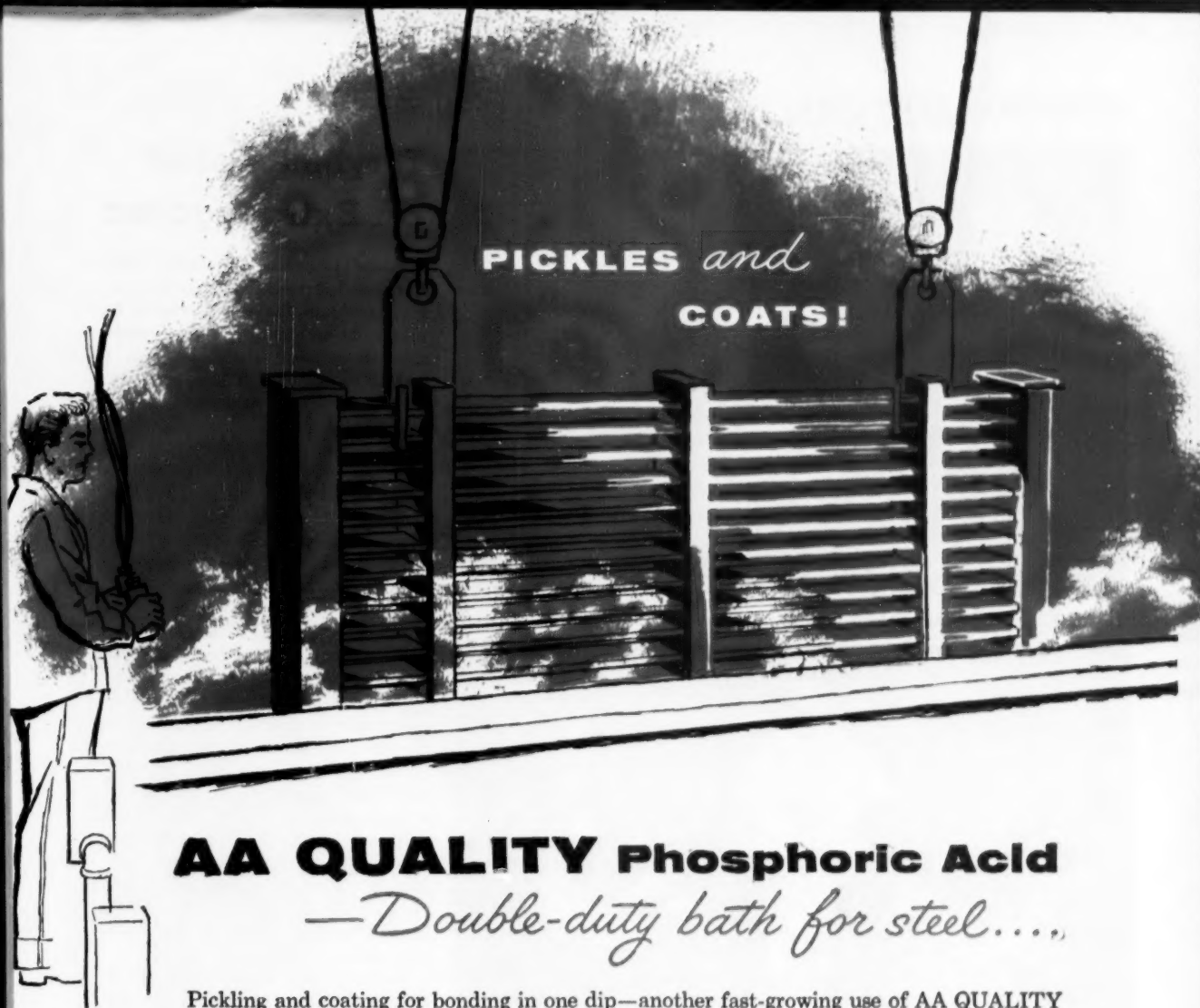
WIDE WORLD

## Noisy Blast, Little Damage

BLAST AT Dow Chemical Co.'s Midland, Mich., plant Sunday a fortnight ago was heard for five miles, injured three employees. Both company and city fire departments responded to the four-alarm call within minutes; damage was held to \$300,000.

Cause of the explosion was not

immediately determined, but company spokesmen say that acrylonitrile was being used in the exploded area in the manufacture of an intermediate product. The building (181-Building) also houses other operations—including Ciba-dyes and glycine production units—not involved in the explosion.



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COATS!**

## **AA QUALITY Phosphoric Acid** *—Double-duty bath for steel....*

Pickling and coating for bonding in one dip—another fast-growing use of AA QUALITY Phosphoric Acid. This chemical of a thousand uses, in its various grades, assures utmost quality with economy. Made from 99.9% pure Elemental Phosphorus produced by A.A.C. electro-thermal process with phosphate rock from our own mines. Rigid quality control from mines to finished product... dependable supply assured by large-scale production and ample phosphate rock reserves. Good reasons for using AA QUALITY Phosphoric Acid and the other products listed below. Data Sheet or samples gladly furnished—write us today.

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50% Pure Food Grade  
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All grades Florida Pebble Phosphate Rock  
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KEYSTONE® Gelatin: Edible, Photographic,  
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TERYLENE'S bow into British market is heralded by distinguished guests.\*



EVENT is marked with a lavish show replete with parading mannequins . . .



. . . promises to make a big splash in the textile industry before year's end.

## Terylene Debut: an Extravaganza

Imperial Chemical Industries Ltd.'s Terylene last week made its first formal bow into the British textile industry. At an extravagantly presented show—complete with champagne, a fashion show, and ultramodern displays—130 individual manufacturers of fabrics and clothing displayed (to the press and consumers) what Terylene, both pure and in blends, can do.

This bid for interest comes less than three months after ICI's \$28-million plant went onstream with an initial rated output of 11 million, capacity by 1957 of 22 million lbs. year (CW, Feb. 12, p. 30).

**Export Potential:** What interested U.S. observers most, however, was the emphasis ICI executives were placing on the export potential of their new product. ICI chairman, Scotsman Alexander Fleck, speaking at the opening of the show, pointed out that he expects Terylene to be a major company export item in the very near future. It has already been licensed for production in Italy, France, West Germany, and the Netherlands; ICI has an 11 million-lb. (\$20-million) plant in production in Canada.

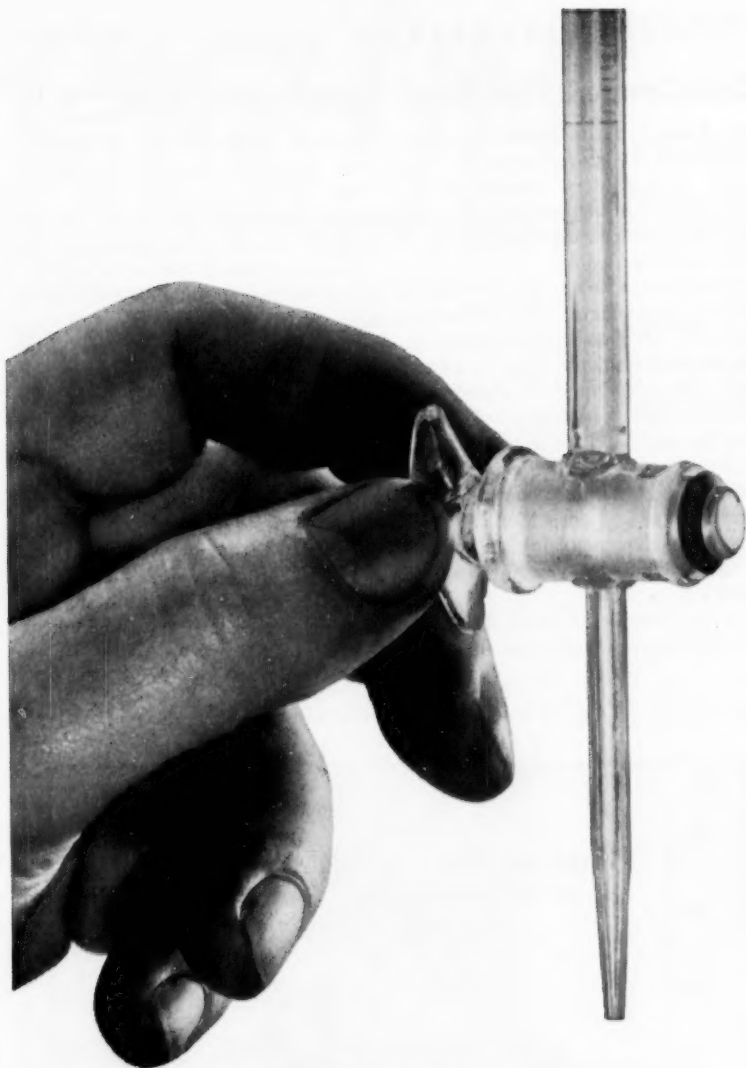
**Inference?** ICI figures that some of this production (11 million lbs. for 14 million people in Canada, 22 million lbs. for 55 million people in Great Britain) will find its way into the lucrative U.S. market.

Because Du Pont holds an exclusive license for manufacture in the States, ICI-Canada can't sell its filament or fiber directly. But there's nothing to prevent processed (if only slightly processed) Terylene from being sold here.

In Britain, the availability of Terylene to the public is increasing rapidly. But ICI expects some 50% of its total production to go eventually to industrial users (chiefly to makers of sewing threads, fishing lines, nets, dye bags, calendar sheetings, press covers, laundry bags, armature insulation, filter cloths, papermakers' felts, oil discharge hose, tire cords, conveyer belting, tents and tarpaulins).

\* Left to right: P. C. Allen, ICI Fibres Director, Mrs. Thornycroft, wife of the Board of Trade Minister, and Alexander Fleck, ICI board chairman.





#### **acetic acid**

- Organic synthesis
- Reaction medium and solvent
- Dyeing assistant

#### **acetic anhydride**

- Acetylating agent
- Dehydrating agent in nitration and sulfonation reactions, etc.

#### **propionic acid**

- Organic synthesis

#### **propionic anhydride**

- Acetylating agent
- Intermediate

#### **n-butyric acid**

- For the preparation of butyric esters useful in formulating perfumes and flavorings.

#### **n-butyric anhydride**

- Acylating agent
- Intermediate

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Especially recommended for higher quality or more expensive bulk chemicals which need maximum protection in shipping and storing. Sturdy, reliable—unusually resistant to impact and pressure. Excellent for anhydrous chemicals or powdered metals. Wide range of sizes.

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**BUSINESS & INDUSTRY**

**One Opened, One Shut**

The Federal Trade Commission last week filed a false-advertising complaint against Merit Pharmacal Co. and closed out another false-advertising case against Foster-Milburn Co., maker of Doan's Pills.

FTC's new case charges Merit with making false claims for the effectiveness of its "X-Tron" hair preparations, one an ointment, the other a lotion. Merit, according to FTC, claims that use of the two preparations will eliminate dandruff and itching scalp, stop excessive hair fall, and make new hair grow. FTC charges none of these claims is true and gives Merit 20 days to answer the complaint. A hearing is scheduled for May 5, in Chicago, Merit's home office.

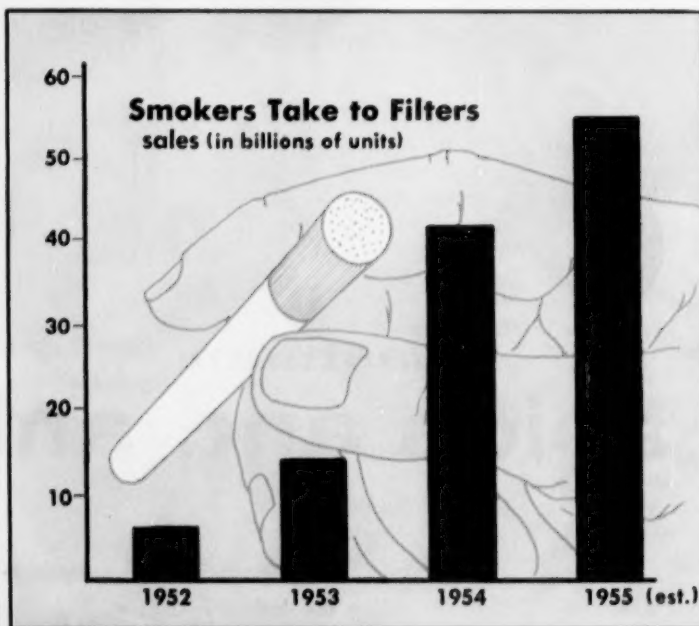
In the Doan's Pills case, FTC approved a consent settlement that bars

Foster-Milburn from advertising the pills as a cure for any diseases or disorders of the kidneys or bladder. The agreement between lawyers for FTC and the company shows that Foster-Milburn intends to change the formula for the pills, increasing the amounts of two of the active ingredients. This will result in greater daily dosages when taken as directed.

The Republican FTC has been grinding out these false-advertising complaints against patent medicine outfits at a steady rate, as have its predecessors.

In recent months, however, the commission has been trying to switch more of its work to higher-priority problems—particularly mergers in which the flood of combinations has been attracting attention—both of Congress and of government enforcement agencies.

**IMPACT**



**Smoking Out Chemical Profits**

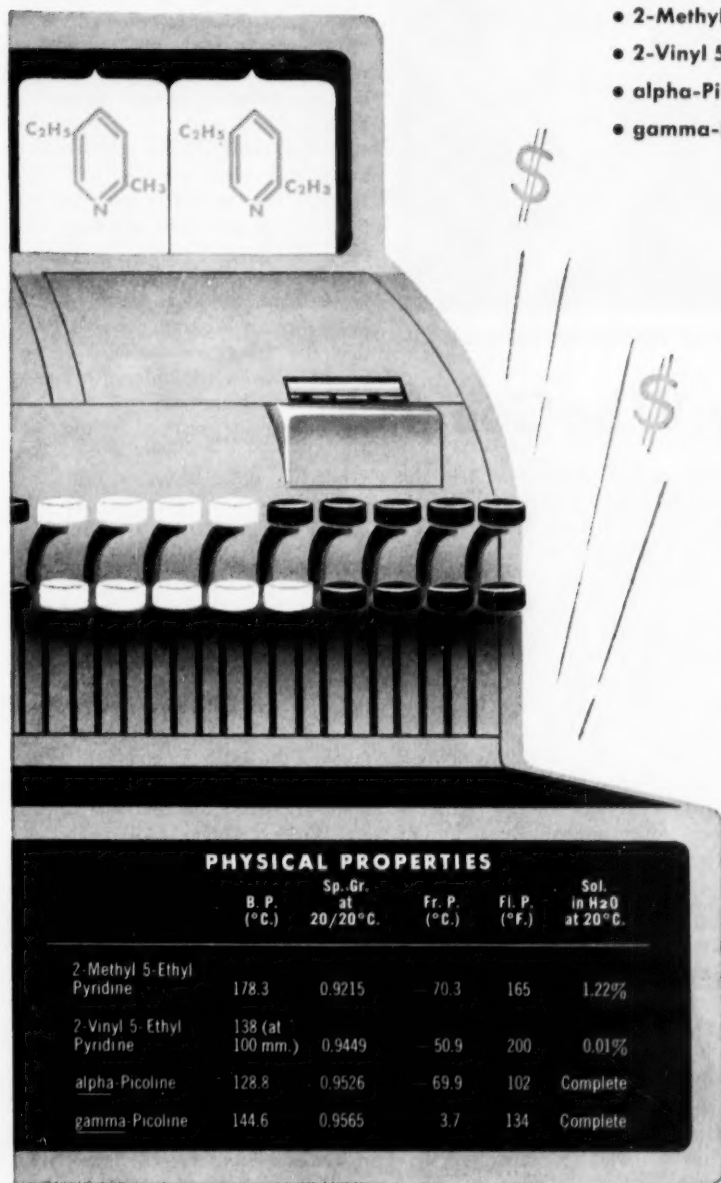
THOUGH TOTAL cigarette sales plummeted about 4.0% last year, chemical suppliers nevertheless profited from the big switch to filtered brands (sales up some 209%).

Reason: in 1954 alone, filters

used up an estimated 36,210 tons of cellulose acetate tow (parallel fibers), 6,390 tons of plasticizers, 1,874 tons of special-grade filter papers, 182 tons of activated carbon, and 8,010 tons of cotton and asbestos mineral fibers.

# CASH IN

## on the **DOLLAR** POSSIBILITIES of CARBIDE'S **SUBSTITUTED PYRIDINES**



**PHYSICAL PROPERTIES**

	B. P. (°C.)	Sp. Gr. at 20/20°C.	Fr. P. (°C.)	Fl. P. (°F.)	Sol. in H <sub>2</sub> O at 20°C.
2-Methyl 5-Ethyl Pyridine	178.3	0.9215	-70.3	165	1.22%
2-Vinyl 5-Ethyl Pyridine	138 (at 100 mm.)	0.9449	-50.9	200	0.01%
alpha-Picoline	128.8	0.9526	-69.9	102	Complete
gamma-Picoline	144.6	0.9565	3.7	134	Complete

- 2-Methyl 5-Ethyl Pyridine
- 2-Vinyl 5-Ethyl Pyridine
- alpha-Picoline
- gamma-Picoline

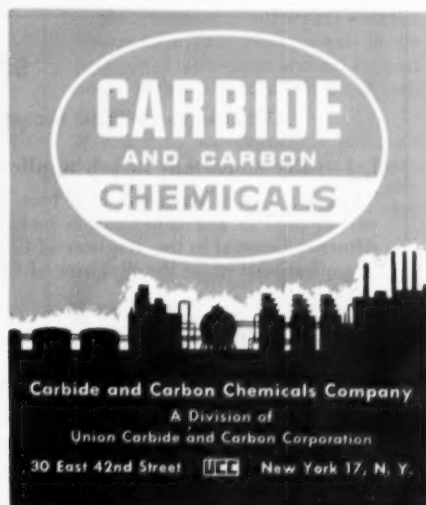
- High Purity
- Direct Syntheses

Here are some profit-making uses for CARBIDE's substituted pyridines: rubber accelerators; tire cord adhesives; solubilized vat dyestuffs; pharmaceuticals such as isoniazid, niacin, and antihistamines; and solvents for chemical processes. One or more of these substituted pyridines have also shown promise in the production of new textile fibers, elastomers, and ion-exchange resins.


Production of pyridines at CARBIDE is independent of other processes — each of these substituted pyridines can be made in large quantities.

**FURTHER INFORMATION** on the possibilities of these pyridines is available from the CARBIDE office near you. Ask for samples. *In Canada: Carbide Chemicals Company, Division of Union Carbide Canada Limited, Toronto.*

*Remember . . .* These pyridines can be shipped in tank car quantities. In addition, samples of 5-ethyl 2-methyl piperidine (boiling point 96°C. at 100 mm.) and 2-(2-hydroxyethyl) 5-ethyl pyridine (melting point 45°C.) are also available.



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CALIFORNIA'S SCHAUER, TRAYNOR: Their clashing opinions spark . . .

## Search for Policy: Who Goes?

Few chemical companies have so far formulated a policy on what to do with "Fifth Amendment" employees, it's shown by a CW survey this week. Which ones should be fired, which ones retained, which ones transferred? That right now might be a good time to set a policy on these matters—even though the industry appears to be singularly free of subversives—is indicated by the California State Supreme Court's recent 4-to-3 decision relating to a chemical process firm (CW Newsletter, Jan. 29).

The court's majority opinion—written by 64-year-old Justice B. Roy

Schauer of Los Angeles—upheld the right of Berkeley's Cutter Laboratories to discharge a woman described as a dedicated Communist. "There is no more elemental cause for discharge of an employee than disloyalty to the employer," Schauer wrote. "It must be accepted as conclusively established that a member of the Communist party cannot be loyal to his private employer as against any directive of his Communist master." The dissenting opinion by Justice Roger Traynor accused the majority of abrogating the rights of both employers and employees, and of depriving citizens of their civil rights.

**Few Cases Found:** That chemical management is aware of the principles involved in this issue is apparent from replies to CW questionnaires. Caution and fair play are the prevailing attitudes; most replies state that the company had not yet faced such a problem, and that any future case would be decided on its merits.

During the past few years, only rarely have "loyalty cases" turned up in the chemical process industries. Examples:

- Mrs. Doris Walker, a lawyer posing as a file clerk, got a job at Cutter Laboratories in 1946, soon became president of the local union in that plant. The company says it discovered in 1947 that she had a Communist background. She was discharged in 1949, but an arbitration board ruled that the firing was because of her union activities and ordered her reinstated. A trial court affirmed that finding, only to be overruled by the state supreme court, which termed her deeds "not union activities, but Communist activities." Mrs. Walker may ask for a review by the U.S. Supreme Court.

- Harvey Baker, who has been a production worker for the past several years at the Swift & Co. plant at Fort Meade, Fla., was questioned last December by the House Committee on un-American Activities. Asked about alleged Communist associations, Baker invoked the Fifth Amendment. Within a month, he was tried by his local union—Local 38, International Chemical Workers Union (AFL)—and expelled. Baker can still appeal to the

### SCREENING FOR SECURITY

(What some chemical companies are using to screen out any employees found to be "Reds")

#### I. Loyalty statement in job application:

"Are you now or have you ever been a member of or participated in any organization included by the U.S. Attorney General in the 'Register of Communist-Action Organizations' or in the 'Register of Communist-Front Organizations'?"

Yes \_\_\_\_\_

No \_\_\_\_\_

"If you hereafter become affiliated with or participate in any such organization, do you agree to disclose this fact immediately to \_\_\_\_\_ Corp.? (Answer) \_\_\_\_\_"

#### II. Agreement on "discharge for cause":

"The union and the company agree that the company may discharge an employee (1) who is a member of the Communist party, or (2) who is proven to be directly or closely associated with the Communist party or any other organization that advocates the overthrow of the U.S. government by force, or (3) who has invoked the Fifth Amendment to the U.S. Constitution in any federal or state court proceeding or in any Congressional or legislative inquiry when interrogated as to Communist activity or affiliation with an organization that advocates the overthrow of the U.S. government by force."





COMMUNISTS FOSTER, DOYLE: In prewar years, union infiltration.

ICWU executive board.

• A certain large chemical company assigned an employee to a laboratory that was doing classified work for the federal government. When he failed to receive clearance, the management asked him about it. "His admissions of doubtful activity," the company relates, "were so patent that even he could see why he could not be useful, and a termination ensued."

**Postwar Purge:** There are relatively few actual or potential "Fifth Amendment Communists" in the industry now; but things were different only a few years ago. Communist infiltration into U.S. and Canadian labor unions began some 35 years ago. In 1921, U.S. Communist leader William Z. Foster went to Moscow as a delegate to the Red International of Labor Unions. There it was decided that Foster's Trade Union Educational League would organize "cells" in AFL unions to agitate for reorganization along industrial rather than craft lines; and numerous "left-wingers" were in the front ranks when CIO was formed to boost industrial unionization.

From 1947 through 1951, both AFL and CIO were busy purging allegedly Communistic unions and individuals. All three major unions in the chemical field now bar Communists and Fascists from membership; but all three of these unions—generally unknowingly—formerly made use of persons found to be Communists. (For instance: ex-Vice-President Charles Doyle of CIO's chemical union, deported in 1953.)

On the professional level, a number of scientists were affiliated with Communist-front organizations.

For any chemical company that may find on its payroll a person who uses the Fifth Amendment to avoid telling about his past or present connections, there's a nasty dilemma to be faced: publicity-wise, is it worse to keep such an employee and be accused of "harboring Communists"; or to fire him and be accused of abridging rights guaranteed by the Constitution? What will be the effects on relations with customers, government, stockholders, employees, and plant communities? What precedents will be set on tolerance or nontolerance of unpopular political views among employees?

A number of chemical companies are trying to steer clear of any such situation by including in their job application forms a loyalty question (*see box, p. 28*). At least one company has worked out a definite understanding with a union providing for discharge of "Fifth Amendment Communists"; the company adds that this was requested by the union.

One large chemical firm's tentative policy: "We would suspend the employee until he has been given opportunity to explain his position and we have had an opportunity to investigate his assertions." Says a medium-size concern: "We would not fire a man for Communistic tendencies *per se*, but would have to have reasons and proof to back up any discharge that might go to arbitration."

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Magic? Well, perhaps not. Technically, a dispersant might be defined as a chemical product which prevents the flocculation of insoluble solids in a liquid medium.

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If you need a dispersant or emulsion stabilizer in your products or processes, evaluate the Marasperses. Use the coupon below to obtain further technical information.

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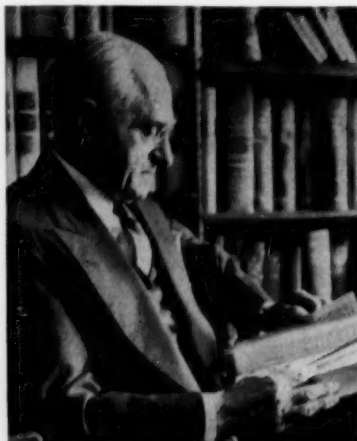
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## BUSINESS & INDUSTRY . . . . .



WIDE WORLD  
**JUSTICE FRANKFURTER:** In borderline labor cases, U.S. courts wait.

### Not Right, Not Banned

If your company is in interstate commerce and a labor union strikes to win recognition, you're not supposed to go to a state court to get an anti-picketing injunction; but if you do choose to go into a state court, nobody can stop you.

That's the U.S. Supreme Court's latest ruling in its current attempt to stake out a more discernible boundary in the shadowy no-man's-land where state and federal jurisdictions meet on labor controversies (CW, April 9, p. 36).

Associate Justice Felix Frankfurter—who wrote the majority opinion in this case—admits that the doctrine is somewhat involved, but says it will have to stand until the state-federal borderline on industrial relations is "finally clarified by definitive rulings here or further legislation by Congress."

**NRLB Has Authority:** Actually, the National Labor Relations Board has primary jurisdiction in such cases, along with federal district courts. In the case at issue, however, the employer—Richman Brothers Co., a clothing concern—went to the Ohio Common Pleas Court and got an injunction to halt picketing by the Amalgamated Clothing Workers (CIO).

The union lost its move to keep that injunction from being issued, so it went to U.S. District Court seeking an order for the employer to withdraw his action in the state court. But here the union ran into a stone

wall: at all three levels—district court, appeals court, and Supreme Court—the federal judiciary declared it had no authority to intervene at that stage of the proceedings.

What the union will have to do in this case, Frankfurter explained, is to carry the litigation all the way through the state court system. After that, the case can be appealed to the U.S. Supreme Court—and that body probably will find that the state courts had no jurisdiction.

**Example in Kentucky:** That's just what happened in a Kentucky labor case that the Supreme Court also decided last week. Kentucky's Court of Appeals had upheld a lower state court's order requiring AFL truck drivers to cross another union's picket lines and make deliveries at the American Tobacco plant in Louisville.

In this case, the Supreme Court nullified the state court's injunction, citing two previous high court decisions in similar disputes. In both those cases, the court held that NLRB has exclusive jurisdiction over labor disputes covered by Taft-Hartley.

Chief Justice Earl Warren and Associate Justices Hugo Black and William Douglas disagreed with Frankfurter's reasoning in the Ohio case.

### Safer Every Year

Chemical industry accident rate is less than one-third of the 11.50 (per million man-hours worked) preliminary figure reported for all manufacturing in 1954 by the Bureau of Labor Statistics. And that's a handy plug from the standpoint of public relations.

Lost-time accidents in the industry, as recorded by the Manufacturing Chemists' Assn. General Safety Committee, amounted to 3.27 per million man-hours worked last year—an 11% improvement over 1953 records. Now ranked as one of the safest industries in the country, the chemical industry has reduced its accident frequency rate 57% since 1946.

The MCA safety performance report covers plants in North America representing over 757 million employee hours of exposure. Its findings are good fodder for public relations departments—charged with the task of selling chemical plant safety to the public.



## PROVED PERFORMER

This mass of rubber and steel is a fine example of early automotive design, and is still in running condition today, almost half a century after it was built. It is an antique Cadillac touring car de luxe of the duster and goggles era.

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**THUMBNAIL CHRONOLOGY**

(Dispute over insurance coverage at Ethyl plant in Baton Rouge: how it started, how it stands)

- 1/15/51—Six insurance companies issued five-year "use and occupancy" policy on Baton Rouge plant.
- 5/11/53—Fire occurred in that plant.
- 5/11 to 5/14/53—Total loss of production of antiknock compounds.
- 5/15 to 10/5/53—Partial loss of antiknock production.
- 12/29/54—Insurance companies having refused to pay claims for loss of production, Ethyl filed civil suit in New York.
- 2/3/55—Insurance companies asked that entire complaint be dismissed, or else that certain sections be crossed out.
- 2/24/55—Arguments before Judge Ryan on motion to dismiss complaint or strike out certain sections; the court reserved judgment.

**Insurance Suit: On Rocky Road**

There's a long, long trail awinding for the litigation that's expected—ultimately—to bring a ruling on exactly what protection you get on your plant "use and occupancy" insurance.

The dispute—now nearly two years old—between Ethyl Corp. and six fire insurance companies (*CW*, Jan. 22, p. 26) is bumping along over rocky terrain in U.S. District Court, New York, and the insurance companies are hoping that the case will soon bounce off the road and overturn into the nearest ditch.

Ethyl's attorney Charles Detmar, Jr., is pushing for an early trial on the merits of the case; but the insurance companies—all members of the Factory Insurance Assn.—appear to be in no hurry for such a showdown.

**Dismissal Asked:** Speaking for the insurance firms, defense counsel S. A. Berger has not yet come to grips with the substance of Ethyl's complaint, but he has forcefully attacked its form. Berger has asked the court to dismiss the whole complaint, on the ground that its wording is such as "to prejudice the defendants' right to a fair trial."

Ethyl had sued to collect \$2,389,174 for loss of production because of a fire in the corporation's tetraethyl lead plant at Baton Rouge, La., arguing that its "use and occupancy" policy should provide for compensation for loss of production even when

there's no loss of sales. Ethyl also wants the court to enforce a Louisiana state law that calls for an extra 12% assessment when an insurance company wrongfully refuses to pay a just claim within 60 days.

If the court won't throw out the entire complaint, then Berger wants the complaint to be trimmed and revised. For one thing, he hopes the court will apply scissors to that part in which Ethyl endeavors to explain that there are two types of occupancy insurance—one for merchandisers, who are insured against loss of sales; and one for manufacturers, who are insured against loss of production.

**State Laws Conflict:** This explanation, declares Berger, is an improper "attempt to write a text on use and occupancy insurance in the most abstract terms," and an attempt to influence the court's thinking.

He also is asking the court to blue-pencil Ethyl's request for the extra 12% damages. Berger contends that because of a conflict in state laws, the Louisiana statute can't be enforced in New York.

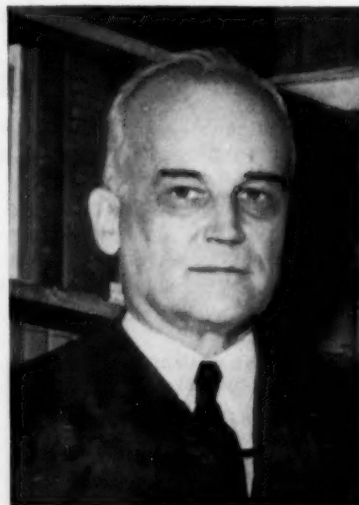
If the ruling on these procedural points goes against the insurance companies, the case will be headed toward a federal court trial—which may be several years in coming. If the ruling goes against Ethyl, that company may feel like starting over in the Louisiana courts.

**LEGAL**

**Drugmakers Rapped:** Two small drug companies have been convicted of violating the federal Food & Drug Act. A Miami firm's amphetamine sulfate was not properly labeled, and a New York concern's products contained penicillin and Aureomycin that hadn't been certified by the Food & Drug Administration. A third product of the New York company did not contain Aureomycin as represented.

**Beryllium Suit Settled:** The last of 25 major personal injury suits against Cleveland's Brush Beryllium Co. has been settled. A reported \$25,000 is going to plaintiff Earl Litz, who had sued for \$350,000. Litz asserted he had been unable to work since 1951 because of impaired health that he said was the result of his having inhaled beryllium fumes from the company's plants. All the suits were based on alleged contamination from the plant during the 1946-48 period.

**Gas Rates Sustained:** Chemical process companies using large quantities of natural gas might take note of the Supreme Court decision penned by Justice Harold Burton in the case of Colorado Interstate Gas Co. The company—fighting a rate reduction ordered by the Federal Power Commission in 1952—was overruled on its plea that it was losing \$420,000/year on its gasoline operations. CIG, says Burton, waited too long to object.



**JUSTICE BURTON:** For Western gas users, 1952 rate cut stands.



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## LEAD NITRATE, Technical Crystal

<b>Pb(NO<sub>3</sub>)<sub>2</sub></b>	<b>F. W. 331.226</b>
Assay (Pb(NO <sub>3</sub> ) <sub>2</sub> )	99.0 %
Insoluble Matter	0.010%
pH of 20% Solution at 25°C.	3.0-4.0
Substances not precipitated by H <sub>2</sub> S (as SO <sub>4</sub> )	0.30 %
Color—White	

## LEAD ACETATE, Technical Crystal Small Crystal Granular 4-20 Mesh Powder

<b>Pb(C<sub>2</sub>H<sub>3</sub>O<sub>2</sub>)<sub>2</sub>·3H<sub>2</sub>O</b>	<b>F. W. 379.35</b>
Assay (Pb(C <sub>2</sub> H <sub>3</sub> O <sub>2</sub> ) <sub>2</sub> ·3H <sub>2</sub> O)	99.0-105.0%
Insoluble Matter	0.020 %
pH of 5% Solution at 25°C.	5.5-6.5
Substances not precipitated by H <sub>2</sub> S (as SO <sub>4</sub> )	0.20 %
Odor: Faint Acetic Acid	
Colorless and free flowing	
Crystal—Size:	
3" and finer	
Small Crystal—Mesh:	
Max. 25% On U.S. No. 4 Sieve	
Min. 75% On U.S. No. 40 Sieve	
Max. 20% Thru U.S. No. 140 Sieve	
Granular 4-20 Mesh:	
Max. 15% On U.S. No. 4 Sieve	
Max. 5% Thru U.S. No. 20 Sieve	
Bulk (untapped): 50 Gm ⇄ 35-42 ml.	
Powder—Mesh:	
Max. 1% On U.S. No. 20 Sieve	
Min. 85% Thru U.S. No. 40 Sieve	
Bulk (untapped): 50 Gm ⇄ 39-56 ml.	

## LEAD DIOXIDE, Technical Powder

<b>PbO<sub>2</sub></b>	<b>F. W. 239.21</b>
Assay (PbO <sub>2</sub> )	90.0 %
Insoluble in HNO <sub>3</sub>	0.20%
Mesh	Max. 1% on U.S. No. 325 Sieve
Color—Light Chocolate Shade	

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## COLTON CHEMICAL

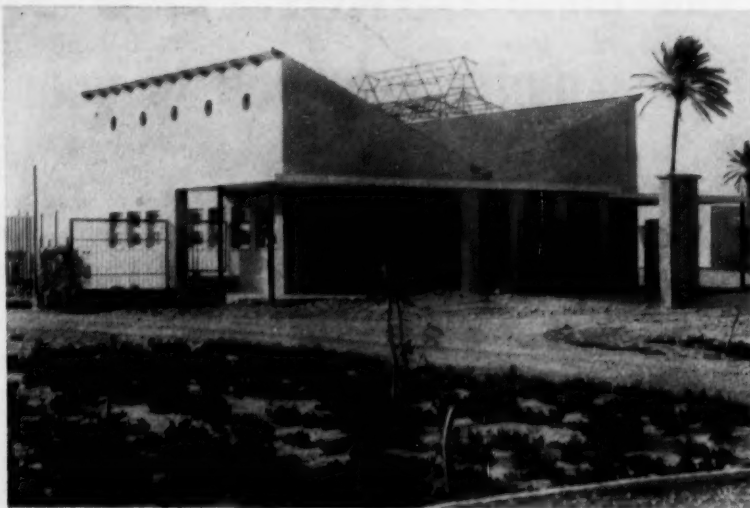


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## BUSINESS & INDUSTRY . . . . .



**ELECTROCHEMICAL INDUSTRIES:** Will bring a \$2.5-million chlorine, caustic soda plant at Haifa onstream late this year.

## FOREIGN . . . . .

**Caustic, Chlorine/Israel:** Electrochemical Industries (Frutarom) Ltd. plans to start production before the end of 1955 at a \$2.5-million plant, 10 miles north of Haifa, Israel. Close to \$1 million of the company's capital has been supplied by U.S. investors; the Israel government supplied \$1.25 million through a long-term loan under its Law for Encouragement of Capital Investments.

Initial daily output will include 8.3 tons of caustic soda; 7.5 tons of chlorine; 3 tons of hydrochloric acid; and 5 tons of benzene hexachloride.

Basic raw materials (chlorine and caustic) will be produced by electrolysis of sodium chloride or potash, using a recycling brine system and the mercury-cell process.

**Japanese-U.S. Agreement:** Sun Chemical Corp. has signed a licensing agreement with Dainippon Printing Ink Mfg. Co., Ltd. (Tokyo).

Under terms of the pact, Dainippon will be able to manufacture Sun Chemical products for the Far Eastern market; Sun agrees to supply technical information and production know-how.

Important stipulation: all products manufactured under the agreement are to be clearly labeled as manufactured under a license from Sun.

**Phenol/Argentina:** Synthetic phenol, which up to now has been totally im-

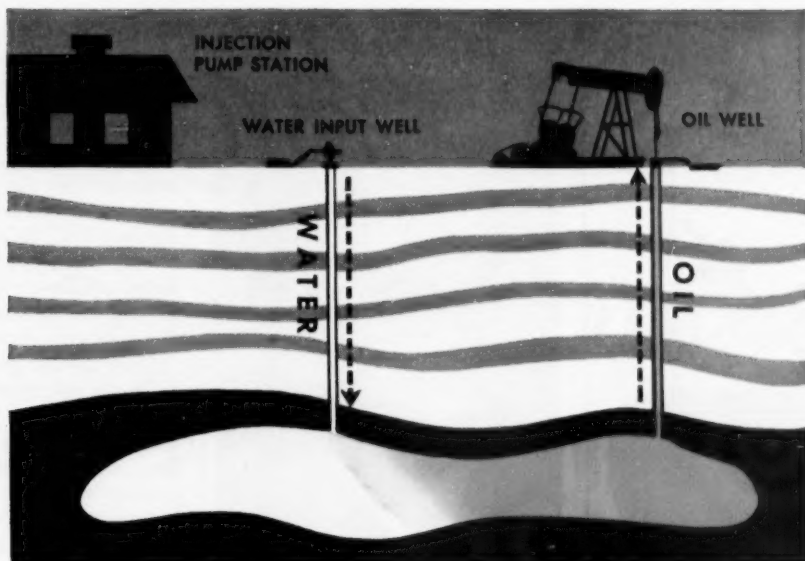
ported into Argentina, will be manufactured locally at a plant in San Nicolás by early 1957.

An investment under Argentina's foreign capital investment law, the plant will be built by Farbenfabriken Bayer (Leverkusen) and Bunge & Born. Approximately half the necessary equipment and machinery will be imported from West Germany; the remainder will be purchased in South America. Estimated capacity: 1,800 tons/year.

**East-West Trade:** The second group of businessmen from the United Kingdom and Hong Kong to visit Peking for discussions with Red Chinese agencies left Hong Kong last week. The group plans to be in the Red capital for three weeks; six British firms (including Imperial Chemical Industries) are represented.

The visit was arranged last November in Geneva between the agents of Red China National Import and Export Committee and the Sino-British Trade Committee (of London).

**Petrochemicals/Venezuela:** Venezuela has decided to build its petrochemical plant in Puerto Cabello, west of Caracas, on the Caribbean Sea. Over \$6 million has already been allocated for the project; Corp. Venezolana de Fomento (CVF), which runs the power plants in Venezuela, has been commissioned to build a 60,000-kw. plant to furnish necessary power.



"Secondary recovery" brings much additional oil from depleted fields, involves injecting Dowicide-treated water into oil-bearing formations to flood the oil to the surface.

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Pipe cutaway (left) shows typical corrosion of metal pipe lines occurring in the presence of sulfate-reducing bacteria.

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## BUSINESS & INDUSTRY.



**GOVERNOR HALL:** In 'right-to-work' fracas, punitive bill vetoed.

## LABOR.

**One Signed, One Vetoed:** There are now 18 states with so-called "right-to-work" laws that forbid union-shop labor contracts; and there'd be one more if it hadn't been for the sharply worded veto message of Gov. Fred Hall of Kansas. Hall denounced the measure passed by his legislature as "not constructive, but punitive." Instead, he urged the lawmakers to pass a bill that would permit union-shop or maintenance-of-membership contracts if favored by the workers.

Latest state to join the right-to-work group: Utah. Its legislature had passed the bill earlier this year, but Gov. J. Bracken Lee waited several weeks before signing it into law.

A right-to-work bill was defeated in the Maryland legislature, but similar proposals are still pending in Colorado, Connecticut, Minnesota, Missouri, Ohio, Oklahoma and Wisconsin.

**First Big Vote:** The new Oil, Chemical & Atomic Workers International Union (CIO) has stood its first big test in a chemical plant election. Challenged by a group of workers that wanted to form an independent or "company union" at Union Carbide's Electro Metallurgical plant at Niagara Falls, N.Y., OCAW local No. 15-250 won the representation poll by a sizable margin. The tally: OCAW, 1,278; Electro Met Independent Union, 310; no union, 13. The rebels had opposed a \$1/month "defense" levy.

**Dime Wage Pattern:** OCAW also appears to be making some headway in getting chemical companies to follow the 10¢/hour wage increase pattern being set by the oil companies this year. In the oil country around Port Neches, Tex., OCAW locals have received 10¢ offers from Port Neches Butane, Jefferson Chemical, and U.S. Rubber and Goodrich Chemical synthetic rubber plants.

More modest pay rises still appear to be the rule in allied industries. At Hamilton, Ont., Firestone Tire & Rubber is boosting wages by 5½¢/hour and three glass bottle-making companies at Millville, N.J., are raising pay rates by 5¢/hour.

**Order to Bargain:** Still another at least partial success for the new OCAW union came when a trial examiner for the National Labor Relations Board recommended to the board that Du Pont be ordered to bargain with the CIO local as the exclusive bargaining agent for all fire department employees in construction operations at the Savannah River atomic project near Aiken, S.C.

**Unemployment Tax:** Chemical companies in Pennsylvania will pay more in state unemployment insurance taxes under a new state law raising benefits from \$30 to \$35/week. Payroll taxes will go up from last year's 1.1% average to a new 1.63% level.

## Caveat Vendor

Liability of suppliers of basic chemicals in death and injury cases is asserted in six civil lawsuits stemming from last October's explosion at the Charles W. Berg Laboratories in Philadelphia.

Attorneys for six of the 10 firemen who lost their lives during and after the blast have named Dow Chemical Co. as one of the six defendants in each of the six \$300,000 suits. Their contention: that Dow employees who delivered chemicals to the Berg plant should have taken notice of the allegedly unsafe conditions there and should have refused—"in the interests of safety"—to make the deliveries.

The other defendants are the Berg Laboratories and that firm's four partners and co-owners, being sued as individuals. The complaints charge that these defendants were "careless





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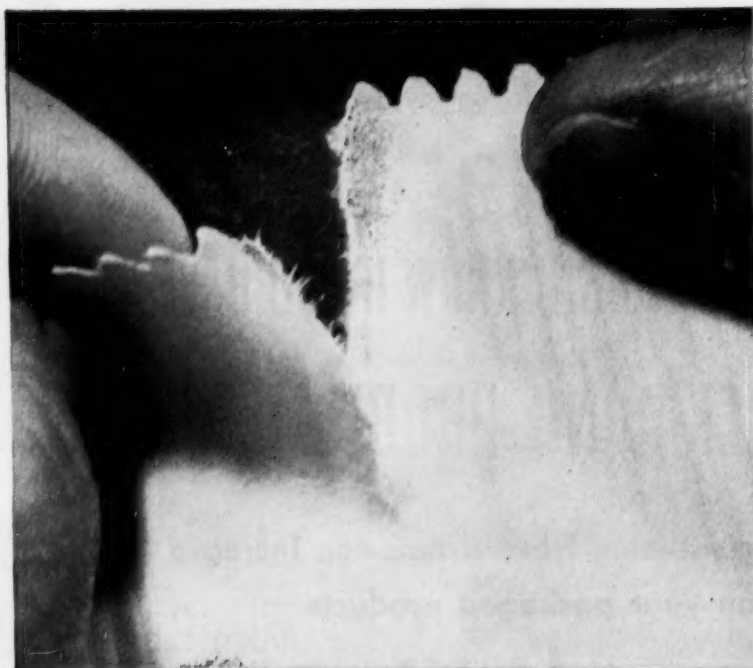


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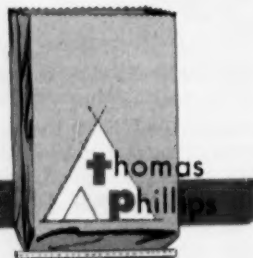
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and negligent, storing chemical mixtures in an improper, careless and highly dangerous manner."

**Coverage Noted:** Eventually, it's expected that a total of 24 suits will be pending in Philadelphia courts on account of the explosion, in that 14 firemen were injured in addition to the 10 who died. It has been brought out at public hearings that liability insurance carried by Berg would cover only a very small part of the damages sought; whereas it's understood that Dow's financial resources and liability insurance coverage are both relatively extensive.

It's likely that Dow will ask the court to strike its name from the list of defendants. If Dow is eventually ordered to pay damages, a precedent will be set for all chemical companies to take responsibility for policing their customers' handling practices.

### **KEY CHANGES. . .**

**Samuel C. Prusky**, to president, Vitamin Corp. of America (New York).

**Arthur Phillips, Jr.**, to director, sales, Solvay Process Division, Allied Chemical & Dye Corp. (New York).

**W. R. Hancock**, to general manager, and **Howard A. Thullbery**, to sales manager, Superior Fertilizer and Chemical Co. (Tampa, Fla.).

**Edward J. Elliott**, to vice-president, Barrett Division, Allied Chemical & Dye Corp. (New York).

**William B. McCloskey**, to vice-president, Administrative Controls Division, W. R. Grace & Co. (New York).

**Frederick H. Roberts**, to director, research, Bakelite Co., Division Union Carbide and Carbon Corp. (Bloomfield, N.J.).

**Raymond L. Geiler**, to vice-president, California operations, Victor Chemical Works (Chicago).

**Sheller L. Steinwender**, to vice-president, Permutit Co. (New York).

**Hugh C. Land**, to general manager, Industrial Chemicals Division, Pennsylvania Salt Mfg. Co., (Philadelphia).

### **KUDOS . . . . .**

To **Granville M. Read**, chief engineer, Du Pont Co. Inc. (Wilmington, Del.), the 1955 ASME Medal.

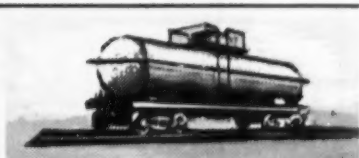
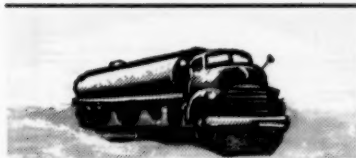


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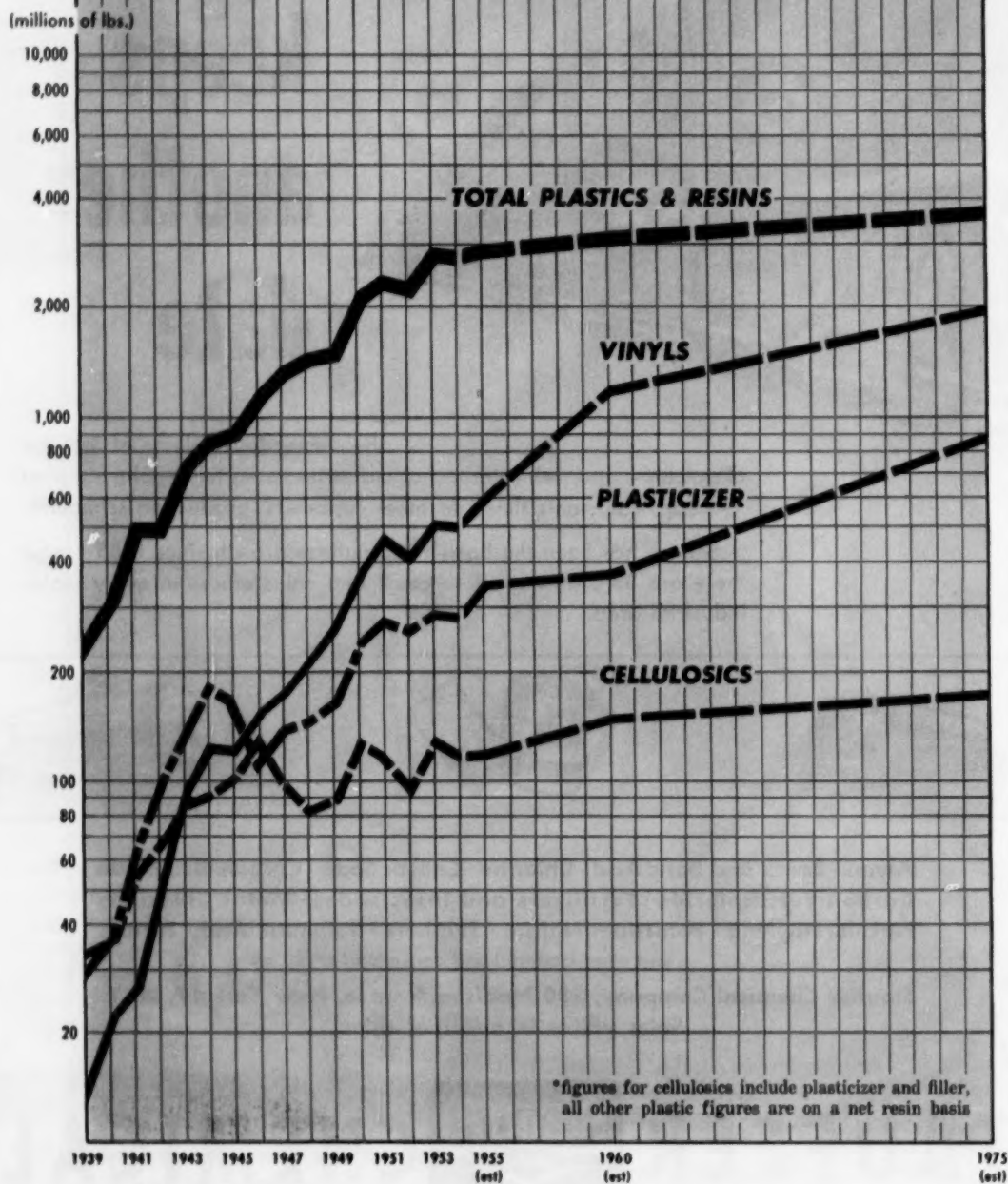
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## STAUFFER



## CHEMICALS

## PLASTICS AND PLASTICIZER PRODUCTION\*





by Irving Skeist

## Plasticizers:

# Treble Output in Twenty Years?

Plasticizer and plastic production suffered a slight setback in 1954 but is expected to resume its upward spiral this year with little letup in the foreseeable future.

Plasticizer output has already increased 10-fold from 1939's 29.8 million lbs.; by 1975, it is expected to be three times today's.

Behind this boom is the spectacular war-born rise in vinyl resins (25-fold since 1939); they soak up most of the plasticizer output.

Phthalate esters account for more than half the volume. Nonplastic uses—e.g., fuel additive and detergent applications—are giving TCP and fatty acid esters a healthy boost.

The ideal plastic, from one aspect, is one that requires no plasticizer.

This year, producers will turn out nearly 3 billion lbs. of plastic. And fortunately for the plasticizer makers, most of this material will be less than ideal, will require more than 300 million lbs. of plasticizer to turn it into the many thousand end products that have become essential on the American scene.

This is the success story of the plasticizer industry. From an unspectacular pre-World War II existence to the present, the industry has expanded output 10-fold over the 15-year span, while dollar sales have jumped 15-fold in the same period.

In reflection, it is also the success story of the vinyl and cellulosic plastics, for it is these two among all plastics groups that consume by far the most plasticizers.\*

**War Baby:** Prior to World War II, plasticizer production was comparatively insignificant; most of it went into surface coatings, safety glass and cellulosic plastics.

With the United States' entrance into the war, plastics development hit a frenzied stride and plasticizer output about doubled within a year. Most of this development involved

\*On an average, each pound of vinyl resin or cellulose ester requires approximately one-half pound of plasticizer to change it into a tough, flexible plastic.

military items—such things as acrylic noses for bombers, vinyl electrical cable, cellulosic housings for bomb fuses, plastic adhesives for bonding wooden airplanes and PT boats. Already established, the cellulose experienced a modest expansion during this period, but it was the vinyls that really burst forth under the pressure of military demands. And with each development and every new application came a greater and more critical call for plasticizers. Too, in a few instances, plasticizers found applications far removed from their primary function; for example, 60 million lbs. of dimethyl phthalate, usually classed as a cellulose acetate plasticizer, was used by the military during the war as an insect repellent.

With the end of the war came plastic "cocoon" for decommissioned guns and equipment, along with an easy and rapid transition of plastics to peacetime outlets. This postwar generation of plastics found a wide range of civilian applications in everything from acrylic dentures to vinyl pipes, from cellulosic hammerheads to polyurethane air cushions. But while the public was becoming familiar with plastics, it learned of plasticizers only as gasoline additives (an estimated 10 million lbs. of TCP will

be sold in 1955 for this purpose) and household detergents.

**What Is a Plasticizer?** There is no exact definition of the term plasticizer. In this report, a plasticizer is considered to be any solvating or softening agent, usually liquid, that is added to the resin to facilitate compounding and improve flexibility. Also, this report is limited to external plasticizers that impart plasticity to the resin through solvent action as distinguished from internal plasticizers that act by altering the resin molecule itself.

Not all plastics and coatings need external plasticizers, of course (see box: *Plasticization and Polarity*). In many fiber-forming polymers, cellulose and polyacrylonitrile, for example, intermolecular bonds are too numerous and too strong to be pried apart by conventional plasticizers. On the other hand, among the thermoplastics, polystyrene and polyethylene have such weak bonds when heated that they can be worked without external plasticizers. Polystyrene latex may be plasticized with phthalates to promote continuous paint film formation at room temperature, and polystyrene and polyethylene become more flexible if blended with selected rubbery polymers; but for plastics usage, neither polystyrene nor polyethylene is improved by blending with the common liquid plasticizers.

The thermosets—phenolics, ureas, and melamines—derive their toughness from fibrous fillers and internal modification of the resin molecule, are usually worked without external plasticizers. And even the vinyls and cellulose esters get along with less external plasticizer when internally plasticized through copolymerization or mixed esterification.

**Where Plasticizers Go:** But to the compounder, plasticizers are not unwelcome. As Carbide and Carbon's Arthur Doolittle points out,\* externally plasticized resins have greater tear strength and better low-temperature properties than those plasticized internally. Moreover, with resins more costly than the plasticizers, cost-conscious compounders try to use as much plasticizer as the product will tolerate, sometimes prefer less efficient (and less expensive) plasticizers to the top-drawer ones.

Consequently, over 300 million lbs. of plasticizer will be absorbed by this

year's 3-billion-lb. bumper crop of plastics. The vinyls and cellulose esters will make up only one-quarter of this plastic production, but will soak up by far the greatest share of the plasticizer output. Intermediate in polarity (see box: *Plasticizers and Polarity*), the vinyls and cellulose esters utilize plasticizers most effectively. The more polar cellulose esters take the more polar, lower alkyl phthalates and triphenyl phosphate; the less polar vinyl chloride resins use the less polar, higher alkyl phthalates and tricresyl phosphate.

**Which Plasticizer?** Not only does each consuming plastic vary in the type of plasticizer it requires; but also different plasticizers are often used to obtain special characteristics. For example, triphenyl and tricresyl phosphates are incorporated to retard burning rate. Few plasticizers have everything the compounder seeks; often, he must blend—e.g., phthalates for compatibility, phosphates for flame-resistance, aliphatic esters for low-temperature flexibility, and so on. At the same time, competition is keen and the compounder has to keep tabs on his pound volume cost (price/pound x specific gravity) since finished plastics such as film, pipe, molded and extruded articles are usually sold on a volume basis.

Moreover, the question "Which plasticizer?" is made more difficult by disagreement among competent for-

\*Arthur K. Doolittle, "The Technology of Solvents and Plasticizers," John Wiley & Sons, Inc. (New York).

## Meet the Author

IRVING SKEIST qualifies as a plasticizer commentator by virtue of a technical background devoted in large measure to this subject.

A polymer consultant and registered patent agent, he obtained his Ph.D. in polymer chemistry at Polytechnic Institute of Brooklyn (where he studied under "Mr. Plastics" Herman Mark), took courses in patent law at Columbia University.

Of the 15 years he has spent in the plastics industry, 10 were with Celanese, where he specialized in polymer research and development. The other five years were about equally divided between polymer research and market development.

At present, he devotes his time to consultation for the polymer industries from his office in Summit, N.J.



mulators. In the quality-conscious vinyl flooring industry, for example, one company prefers phthalates as the main plasticizing component, another uses TCP, while a third includes substantial proportions of both.

To meet all these conditions, chemical producers have developed a broad range of plasticizers (see chart: *Plasticizers*). The variety is enormous; and each year, more than 100 patents are granted on new plasticizers or on new uses for old ones. At present, several hundred materials are offered for sale, and dozens more have hurdled the barriers of economy, compatibility, freedom from odor, and permanency. Here is a rundown on the current plasticizers by major groups:

### Phthalates

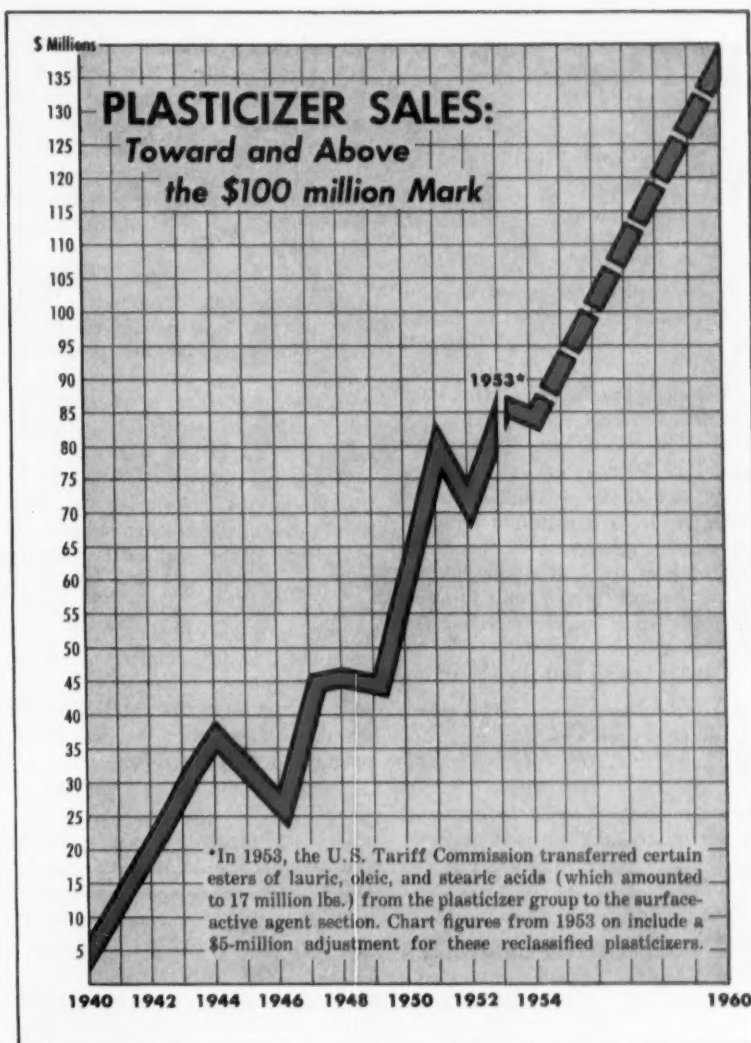
The phthalates offer the best all-round performance at a reasonable cost; they will comprise most of the 300 million lbs. of plasticizer to be synthesized this year. Raw material phthalic anhydride, of course, is closely tied to the coattails of fluctuating steel output, but most of the phthalate plasticizers will be easy to find even in the face of temporary steel sluggishness.†

Within this group, dioctyl phthalate (DOP—the 2-ethylhexyl ester)\* and diisooctyl phthalate (DIOP) are battling for first place. 2-Ethylhexanol is still the favored alcohol for phthalate plasticizers, but the cheaper isooctyl alcohols made by the Oxo process are gaining fast.\*\* Last September, DIOP surged ahead and temporarily took over the top slot; but DOP quickly regained the No. 1 position it held for a decade. Both esters are about equal in compatibility (excellent), volatility (satisfactory), low-temperature flexibility (fair), tendency to migrate (fair), and price (30½¢/lb.). This is how they match up with some of the other

†For optimum steel output, coking operations are pushed in the direction of naphthalene formation, and, of course, result in more derivative phthalic anhydride. On the other hand, when steel is sluggish, frugal coking leads to high yields of cresol and the derivative cresylic acid. But this supply seesaw has only slight effect on the relative prices of TCP and phthalate plasticizers, since cresylic acid and phthalic anhydride are the less costly ingredients of their respective plasticizers.

\*Though there are many dioctyl phthalates, the 2-ethylhexyl ester pre-empted the DOP designation since it was the only dioctyl phthalate commercially available for several years.

\*\*In addition to the C<sub>8</sub> alcohol for DIOP, the Oxo process can economically turn out higher alcohols (to C<sub>13</sub>). Though of lower efficiency, the phthalate esters thereof are establishing themselves as plasticizers. They are less volatile than DOP, sell at the same price, and their lower efficiency is turned to advantage in the formulation of plastisols that have a long shelf life.



more important phthalate plasticizers:

- Di(2-ethylhexyl) phthalate. DOP is compatible with vinyl chloride resins and some cellulose. It lacks flame resistance, but shows good stability with respect to heat and light, moderate resistance to chemical attack, and a low toxicity.

- Diisooctyl phthalate. DIOP is comparable to DOP in almost all significant respects.

- Dicapryl phthalate. DCP also may be substituted for DOP. Capryl alcohol is obtained along with sebacic acid from the oxidative cleavage of ricinoleic acid, is difficult to esterify because it is a secondary alcohol. The characteristic "goaty" odor of the alcohol has been eliminated from today's highly refined ester.

- n-Octyl n-decyl phthalate. nODP is similar to other octyl esters but has better low-temperature flexibility than the branched-chain isomers and finds a ready market despite its premium 34½¢/lb. price. Normal octyl-normal decyl mixtures are obtained as by-products in the manufacture of lauryl alcohol from coconut oil.

- Butyl decyl phthalate. BDP at 27¢/lb. is an economical replacement for DOP even though it is somewhat more volatile than the octyl ester.

- Dibutyl phthalate. DBP is used in nitrocellulose lacquers and polyvinyl acetate adhesives. It is more volatile than DOP, and doesn't find much application in vinyl chloride resins. In addition to plastics and lacquers, DBP was widely used during

the war to plasticize explosives—principally smokeless powder. At present, output is only a fraction of 1945's 46 million lbs.

- **Dimethyl phthalate.** DMP is compatible with most commercial resins, is frequently used with cellulose acetate. Like DBP, it too is a war casualty: Not all the 60 million lbs. of DMP, made as a mosquito repellent for military personnel in the South Pacific, was used; and the surplus is still finding its way into formulations at 15-20¢/lb., undermining the market for fresh material.\*

- **Butyl benzyl phthalate.** BBP, in-

\*Diethyl phthalate, a good cellulose acetate plasticizer, has also seen better days. During prohibition, its bitter taste and lack of odor qualified it as a denaturant for rubbing alcohol and perfume.

compatible with cellulose acetate, is highly efficient with most other resins, is a sellout at 25¢/lb. for use in plastic clothes lines and molded articles where volatility and low temperature properties are relatively unimportant.

A variety of mixed lower-alcohol phthlates are being groomed as competition for butyl decyl and butyl benzyl phthlates.

- **Phthalyl glycolates.** Of higher molecular weight, the phthalyl glycolates are less volatile than the lower alkyl phthalates. They are compatible with most resins; despite their higher cost, their nontoxicity is winning markets for them in plastics for food packaging.

There are other established phthalate plasticizers, of course, and new ones entering the commercial picture every year. Of these, diisodecyl phthalate, only recently in commercial production, looks like one of the most promising. A good plasticizer for polyvinyl chloride, it is similar to DOP in most properties, is less volatile, and sells for the same price. DIDP could unbalance the battle for first place among the phthalate esters.

## Phosphates

The phosphates have a tight grip on second place, and because of their high flame resistance and nonplasticizer markets, seem destined to hold onto it. Equally important, the high compatibility of the aryl phosphates\* with flexible vinyl films, acetate safety film, nitrate lacquers, and most resins, also helps the phosphates hold down second slot.

Despite the advent of gasoline and high-pressure lubricant outlets (which, though important, are only relatively recent), it was this flame resistance that really brought phosphates to the fore. During World War I, triphenyl phosphate was used to retard the burning rate of cellulose acetate coatings on the silk airplane wings; during World War II, tricresyl phosphate was similarly used to flameproof degaussing cable and other electrical vinyl insulation; and today, even when TCP is not used as the primary plasticizer, there is a tendency for vinyl formulators to add some for flame resistance. At present, this is how the phosphates shape up:

- **Tricresyl phosphate.** TCP overshadows the entire group. Though its nonplasticizer applications are responsible for reviving it after some lean postwar years and account for a large share of current output, TCP's excellent flame resistance, very low volatility, high stability, and compatibility with most resins assure it of a top spot among phosphate plasticizers for some time.

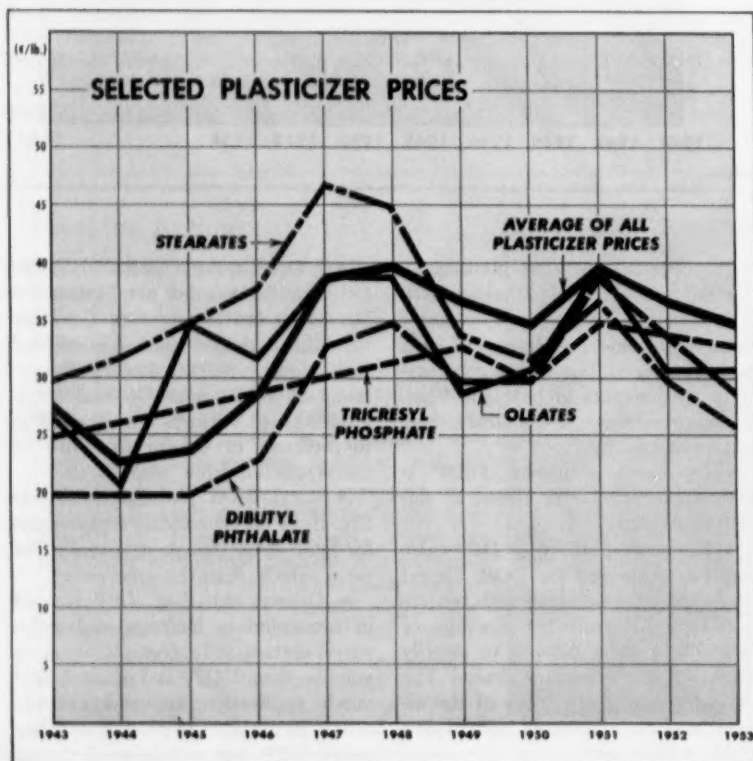
On the other hand, TCP is higher priced than the more popular dioctyl phthalates, lacks low-temperature flexibility, and upon hydrolysis emits a cresylic acid odor.

- **Triphenyl phosphate.** TPP, a solid, is compatible with most resins, is more expensive than TCP. Unlike TCP, it is compatible with cellulose acetate, and is one of the most popular plasticizers for this resin.

- **Cresyl diphenyl phosphate.** It is compatible with most resins, sells at the same price as TCP and is popular when coke-oven cresol is scarce.

- **Octyl diphenyl phosphate.** This is compatible with most resins except cellulose acetate. It is slightly less flame resistant than TCP, has less

\* When the aryl group is completely replaced by the octyl group, the phosphates become less flame resistant, but impart excellent low-temperature flexibility.





odor; it is nontoxic and can be used in contact with food.

Among the other phosphate plasticizers, trioctyl phosphate is a fairly promising prospect. It is less flame resistant than TCP, but imparts greater low-temperature flexibility. Developed in answer to a Quartermaster Corps request for a fungus- and flame-resistant plasticizer, TOF needs a big civilian market to drop its present 43½¢/lb. sale price.

### Polybasic Acid Esters

The outstanding characteristic of this plasticizers group is its contribution to low-temperature flexibility. Plastics tend to become brittle at low temperatures, and articles such as folded vinyl film must be protected against cracking during the winter months. Internal plasticization can mitigate this, but is generally more costly than using these external polybasic plasticizers.

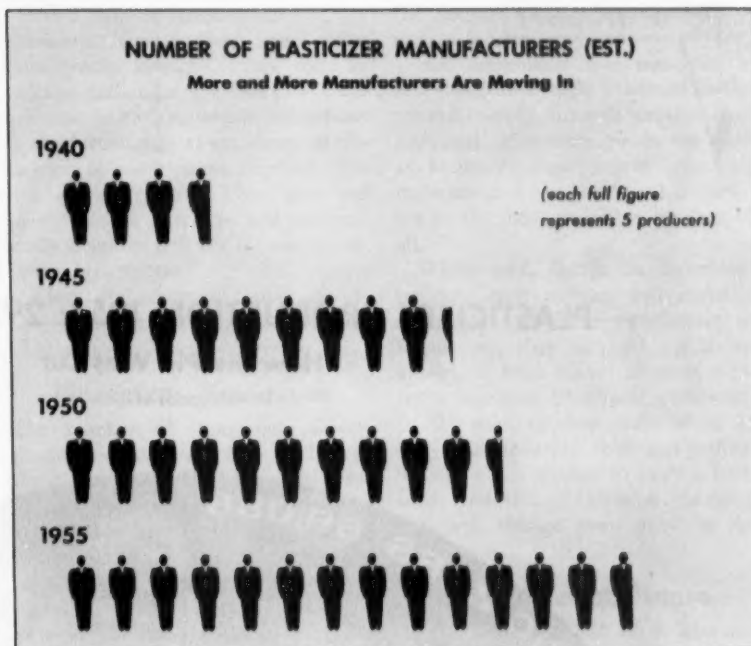
On the whole, this group is compatible with most of the available resins except cellulose acetate. The octyl and decyl esters of the C-6, C-9, and C-10 aliphatic dibasic acids are noteworthy for the low viscosity and long shelf life they impart to vinyl plastisols as well as for their low-temperature characteristics.

Within the group, sebacates, derived from castor oil, are the least volatile (volatility decreases as molecular weight increases), have the best low-temperature properties, and will become more popular if domestic crops can force down the price of imported Brazilian castor beans. Adipates are the cheapest subgroup, but are also the most volatile. The azelates (derivatives of azelaic acid, which is produced along with pelargonic acid by splitting oleic acid with ozone) are slightly more expensive than the adipates, but offer better permanence than the latter.

In competing for the low-temperature market, the polybasic acid esters have little to fear from most other groups except monobasic acid esters; and even here, the competition is far from fierce.

### Monobasic Acid Esters

Generally lower priced than the esters of dibasic acids, this group is about equivalent in its ability to impart low-temperature flexibility to resins. Used in small proportions, the higher



acid esters, butyl stearate and butyl oleate, are regarded as excellent lubricants, serve to improve molding and extrusion rates, help prevent sticking of the plastic to the mold.

But most of the monobasic acid esters are classed as secondary, or borderline primary, vinyl plasticizers. The most compatible esters in this group, the mono-alkanol esters of fatty acids having 6-12 carbon atoms, are too volatile to be of much value. Preferred are the glycol diesters such as polyethylene glycol di-2-ethylhexoate, diethylene glycol dipelargonate, and the like. On the other hand, the ether linkages in these polyglycol esters require special stabilization. Cheaper polymethylene diols would be a boon to the plasticizer producer, would enable him to improve stability as well as compatibility of these compounds.

On the technological side, the acyloxy esters of this group have received a big assist from the work on fatty acids carried out by the Eastern Regional Laboratory of the U.S. Dept. of Agriculture.

### Epoxy Derivatives

Out of this same work came the epoxy fatty acid esters. Used in moderation (up to 5% of the resin), they

serve as both stabilizers and plasticizers for the vinyl chloride polymers. For the compounder, this happy combination of characteristics represents a most welcome addition to the restricted circle of vinyl resin stabilizers.

In the earlier days of plastics, vinyl chloride polymers were exasperatingly unstable. Hydrochloric acid pulled away from one pair of carbon atoms; this in turn encouraged the departure of another hydrochloric acid molecule from the adjoining pair of carbon atoms, and so on. This autocatalytic decomposition swept through the vinyl chloride molecule like a little hurricane, leaving in its wake conjugated double bonds supersensitive to oxidation; and the remnant polymer quickly blackened upon exposure to light or heat.

Now epoxy derivatives are added to the polymer, react with hydrochloric acid as fast as it forms, thus localizing the damage and stabilizing the resin.

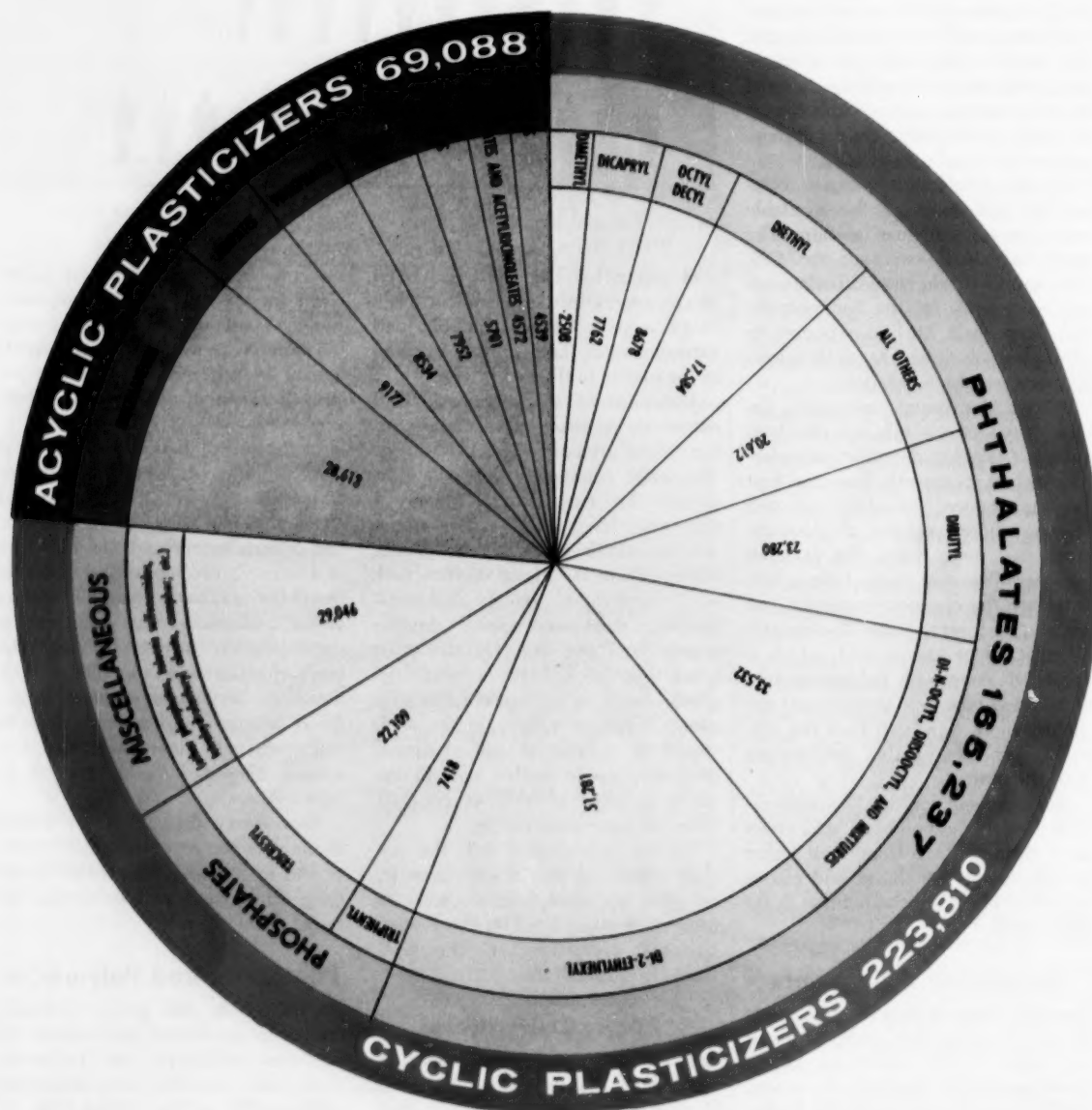
### Polyethers and Polymeric

On the whole, this group is usually limited to specialized applications. Of the two subgroups, the polymeric plasticizers are the more important commercially at the present time.

# PLASTICIZER PRODUCTION 1953: 292.9 million lbs.

## How the Pie Was Cut

(in thousands of lbs.)



Generally, the polymeric are saturated polyesters of dibasic acids and glycols, with some mono-functional acid or alcohol thrown in to control molecular weight or reduce cost. Those in greatest use are viscous liquids or soft resins of 1,000-7,000 molecular weight. These polymeric do not volatilize; those of highest molecular weight don't migrate in contact with lacquers, nor are they easily leached out by solvents, oils or soapy water. But the best ones are also the most expensive and difficult to handle; and so their use is limited to critical applications in which they are needed to minimize migration and extraction.

In somewhat the same fashion as the polymers, high-molecular-weight elastomers are sometimes added to resins. GR-S, for example, multiplies polystyrene's impact strength several fold; and polyisobutylene is added to polyethylene to make the latter more flexible. But these blends are generally termed "alloys" rather than "plasticized compositions."

### Hydrocarbons and Halogenated Hydrocarbons

Though some members of this group impart useful characteristic to resins, the hydrocarbon subgroup is made up for the most part of extenders whose main purpose is to reduce cost. Generally—but with conspicuous exceptions—these extenders are low-priced liquids, which the resin readily spews out; and even the little that the resin will tolerate usually has poor plasticizing qualities.

On the other hand, some of the halogenated hydrocarbons impart flame resistance to the resins, find application as secondary plasticizers for vinyl chloride resins. And some of the comparatively cheap aromatic oils provide resins with a desirable lubricity.

(Neither a plasticizer nor a member of this group, a solid filler nevertheless

serves a purpose similar to that of the extenders. Though they often cause poor tensile strength, fillers such as calcium carbonate, are, like extenders, low-cost materials, which are added to the formulation to cut down on the amount of costly resins required. Unlike extenders, solid fillers give the plastic greater hardness, and are generally compensated for by use of additional plasticizer.

There are, of course, other important ingredients that go into making plastics and other plasticizers.)

### Plasticizer Producers

The number of companies making plasticizers has multiplied by 5 over the past 15 years (see chart: *Plasticizer Manufacturers*). More and more are coming in all the time: for instance, Gordon-Lacey Chemical Products Co., Inc. is presently building a plant to make monomeric and polymeric plasticizers; in reply to CW's survey, Continental Oil Co. said, "Currently we are not actively marketing either primary or secondary plasticizers. But this picture may change in the near future." Many other negative replies were similarly qualified.

Moreover, many companies not classed as direct producers supply others with raw materials for plasticizers. And there are several firms not listed that make plasticizers for captive consumption. With competition becoming keener, the nonintegrated producer may be forced to turn to the premium-priced specialties in order to survive.

**Upward Integration:** In the past, development within the industry has followed to a great extent a pattern of vertical integration from raw material to finished plasticizer: Archer-Daniels-Midland was handling fats and oils long before it started making epoxy plasticizers. Baker Castor Oil, of course, started with castor oil, later turned its hand to the production of ricinoleic and other plasticizers. Monsanto was dealing with phosphates (among other raw materials) before taking on production of phosphate plasticizers. Pittsburgh Coke & Chemical was marketing phthalic anhydride and cresol before it got into phthalates and TCP. The roster of examples could go on, but the reasoning behind it is already evident: the plasticizer producer who controls neither raw mate-

rial nor outlets faces a somewhat uncertain future.

Not controlling raw materials, a few companies have achieved outlet control, mostly through captive consumption. Plasticizer producers such as Monsanto—that control both raw materials and (to a degree) outlets—are in the most favorable position of all.

While such things as individual position, new entries, and material control are of little significance in themselves, they do add up to an important total effect: sharper competition among plasticizer producers. In the past, markets came along so fast and unevenly that competition seldom got a chance to grab a foothold; but this situation is changing and will change even more in the future.

### Past, Present, Future

**In the time since 1870** when John and Isaiah Hyatt first used a plasticizer (camphor) to turn nitrocellulose into celluloid, the plasticizer industry was born, enjoyed an extended youth, and entered a frenzied adolescence from which it is only now emerging.

**Past:** Commercial development was leisurely in the early days. The Japanese established a camphor monopoly, faced no serious challenge until the advent of the aryl (triphenyl and tricresyl) phosphate plasticizers almost a half century later. Not only were the phosphates less volatile than camphor, but they were also less flammable and mitigated celluloid's big defect, combustibility. As a result, the newcomers took hold, broke the Japanese grip and forced the price of camphor down drastically—from \$4/lb. to 65¢/lb.

Nitrocellulose lacquers and cellulose acetate made their commercial appearance after the turn of the century; and with the discovery of the compatible lower alkyl phthalate plasticizers, the plasticizer industry was commercially under way by the mid-'20s.

Mostly captive, the industry followed the shifting fortunes of the cellulose until the late '30s. At this time the vinyl polymers began to assert themselves; the vinyls required—instead of the methyl, ethyl, and butyl phthalates, which blended so well with the cellulose—a higher alkyl phthalate plasticizer. 2-Ethylhexanol,

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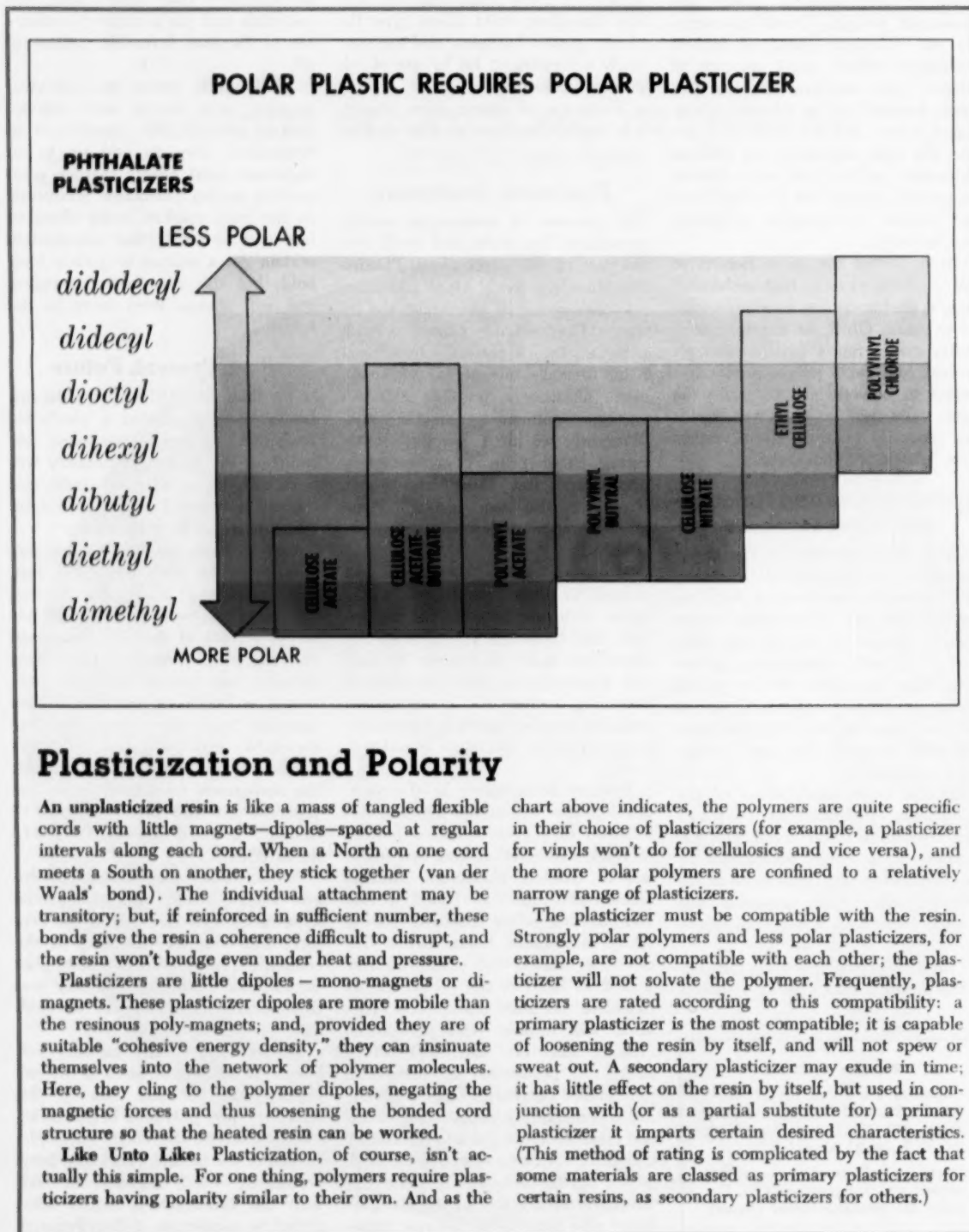
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synthesized from acetaldehyde, was made to react with phthalic anhydride to make DOP, the first commercially available phthalate plasticizer for vinyls.

**Present:** The military demands of World War II gave the plasticizer industry a big assist, ensconced the phthalates and phosphates securely in the top two volume slots. At war's

end, there was not enough plasticizer to match growing resin output. New plasticizer plants sprang up by the dozen—some to sate captive consumption, a few to take advantage of a





raw material position, others merely to exploit the seller's market.

Balance between supply and demand was almost regained when the Korean conflict came along. Hoarding by users during this period kept the ester kettles at full boil. In 1952, production reversed itself, dropped

into a slump as inventories were worked off. A 5-million-lb. fuel additive market salvaged TCP in 1953; production of the other plasticizers slowly perked up as inventories thinned down.

Last year, output fell off once again (see chart: *Plastics and Plasticizer Production*), but is already showing signs of reviving. Increase this year in demand for such articles as plastic floor tiles and plastic fabric coatings is expected to boost plasticizer production 50 million lbs. above peak 1953 output. At the moment, production is paced to consumption; and both are headed up.

**Future:** This upward spiral, experts

figure, will continue with insignificant setbacks for at least the next two decades. Better and cheaper starting materials will continue to be the key to vinyl and cellulosic plasticizer development. Among the more promising precursors: sebacic acid, terephthalic acid, hexane and polymethylene diols.

On the other hand, the more polar polymers will continue to challenge the polymer chemist. Polar polymers such as nylon, polyacrylonitrile, and the proteins are restricted to such a narrow range of suitable plasticizers that any producer marketing a new material for these polymers will be more than welcomed into the fold.

### Noncaptive Plasticizers: Manufacturers, Tradenames, Price, Specific Gravity, and Molecular Weight

CHEMICAL NAME	TRADENAME	MANUFACTURER	SPECIFIC GRAVITY OR DENSITY	PRICE (\$/LB.)	MOLECULAR WEIGHT
<b>PHTHALATES:</b>					
Butyl benzyl	Sant. 160	Monsanto Chemical	1.116	.25	312
Butylbutoxyethyl	Sant. B-16	"	1.097	.4875	336
Butyl cyclohexyl	Elastex 50-B	Barrett Div. Allied Chemical & Dye	1.078	.25	304
Butyl decyl	PX-114	Pittsburgh Coke & Chemical	0.985-0.997	.27	362
"	Sant. 603	Monsanto Chemical			
"	BDP	Hatco Chemical			
"	Elastex 40-P	Barrett Div. Allied Chemical & Dye			
Butyliso decyl	RC BIDP	Rubber Corp. of America	0.998	.27	362
Dibutoxyethyl	—	Kessler Chemical	1.057-1.063	.33-.36	366
"	Kronisol	Ohio-Apex Div. Food Machinery & Chemical			
Dibutyl	—	Barrett Div. Allied Chemical & Dye	1.04-1.05	.30-.33	278
"	Celluflex DBP	Celanese Corp. of America			
"	—	Commercial Solvents			
"	Darex	Dewey & Almy Chemical Div. W. R. Grace			
"	—	Griffin Chemical			
"	Harflex 140	Harchem Div. Wallace & Tiernan			
"	Polycizer DBP	Harwick Standard Chemical			
"	DBP	Hatco Chemical			
"	—	Monsanto Chemical			
"	Morflex 140	Morton-Withers Chemical			
"	NL-A10	National Lead			
"	PX-104	Pittsburgh Coke & Chemical			
"	—	Reichhold Chemicals			
"	RC DBP	Rubber Corp. of America			
"	CP 907	Sherwin-Williams	1.23	.5825-.59	330
"	—	Tennessee Eastman			
"	—	U. S. Industrial Chemicals Div.			
"	—	National Distillers Products			
"	Witcizer 300	Witco Chemical	0.966-0.975	.295	390
Dicapryl	Elastex 80-P	Barrett Div. Allied Chemical & Dye			
"	Harflex 180	Harchem Div. Wallace & Tiernan			
"	Polycizer DCP	Harwick Standard Chemical			
"	DCP	Hatco Chemical	0.964-0.967	.305	446
"	—	Reichhold Chemicals			
"	Monoplex DCP	Rohm & Haas			
Dicyclohexyl	KP-201	Ohio-Apex Div. FMC			
"	Elastex DCHP	Barrett Div. Allied Chemical & Dye	0.964-0.967	.305	446
Didecyl	DDP	Hatco Chemical			
"	Morflex 130	Morton-Withers Chemical			
"	Elastex 90-P	Barrett Div. Allied Chemical & Dye			
"	—	Reichhold Chemicals	0.964-0.967	.305	446
"	Cabflex DDP	Godfrey L. Cabot			

CW Report

CHEMICAL NAME	TRADENAME	MANUFACTURER	SPECIFIC GRAVITY OR DENSITY	PRICE (\$/LB.)	MOLECULAR WEIGHT
<b>PHthalates;</b>					
Diethyl	—	Barrett Div. Allied Chemical & Dye	1.117-1.1205	25	222
"	—	Kay-Fries Chemicals			
"	—	Tennessee Eastman			
"	—	U. S. Industrial Chemicals Div.			
"	—	National Distillers Products	0.98-0.987	.305-.335	390
"	—	Monsanto Chemical			
Di-2-ethylhexyl	Cabflex DOP	Godfrey L. Cabot			
"	Elastex 28-P	Barrett Div. Allied Chemical & Dye			
"	Diocetyl phthalate	Ohio-Apex Div. FMC			
"	Flexol DOP	Carbide and Carbon Chemicals			
"	Celluflex DOP	Celanese Corp. of America			
"	Staflax DOP	Decy Products			
"	Morfex 110	Morton-Withers Chemical			
"	NL-A20	National Lead			
"	—	Tennessee Eastman	1.121	.40	398
"	Witcizer 312	Witco Chemical			
"	DOP	Monsanto Chemical			
Diethoxyethoxyethyl	Di "Carbitol" Phthalate	Ohio-Apex Div. FMC	0.9586	.305	396
Di(2-ethylhexyl) hexa-	Flexol CC-55	Carbide and Carbon Chemicals			
hydro	Harflex 160	Harchem Div. Wallace & Tiernan			
Diethyl	—	Tennessee Eastman	1.040	.29	278
Diisobutyl	Plastoflex 520	Advance Solvents & Chemical	0.983	.385	—
Diisobutyl carbonyl	—	—			
Diisodecyl	PX-120	Pittsburgh Coke & Chemical			
"	DIDP	Monsanto Chemical	.096-0.966	.305	446
"	Darex	Dewey & Almy Chemical Div. W. R. Grace			
"	—	Ohio-Apex Div. FMC			
Diisooctyl	Elastex 10-P	Barrett Div. Allied Chemical & Dye	0.98-0.988	.305-.335	390
"	Harflex 120	Harchem Div. Wallace & Tiernan			
"	DIOP	Monsanto Chemical			
"	—	Reichhold Chemical			
"	RC DIOP	Rubber Corp. of America			
"	PX-108	Pittsburgh Coke & Chemical			
"	Witcizer 313	Witco Chemical			
"	—	Tennessee Eastman			
"	CP 1244	Sherwin-Williams			
"	NL-A30	National Lead			
"	Morfex 100	Morton-Withers Chemical			
"	—	Montrose Chemical			
"	Hercoflex 200	Hercules Powder			
"	—	Griffin Chemical			
"	Darex	Dewey & Almy Chemical Div. W. R. Grace			
"	Staflax DIOP	Decy Products	1.165-1.172	.37-.425	282
"	DIOP	Hatco Chemical			
"	DIOP	Ohio-Apex Div. FMC			
"	Cabflex Di-OP	Godfrey L. Cabot			
Dimethoxyethyl	Methox	Ohio-Apex Div. FMC	1.189-1.193	.275	194
"	—	Kessler Chemical			
"	—	Tennessee Eastman			
Dimethyl	—	Tennessee Eastman	0.967	.335	408
"	—	Monsanto Chemical			
"	—	Barrett Div. Allied Chemical & Dye			
"	—	Kay-Fries Chemicals			
Diocetyl	Darex	Dewey & Almy Chemical Div. W. R. Grace	0.973	.335	418
"	PX-138	Pittsburgh Coke & Chemical			
"	DOP	Hatco Chemical			
"	Good-rite GP-261	B. F. Goodrich Chemical			
"	—	Griffin Chemical			
"	—	Montrose Chemical			
"	CP 1226	Sherwin-Williams			
"	—	Reichhold Chemicals			
"	RC DOP	Rubber Corp. of America			
"	Polycizer 162	Harwick Standard Chemical			
"	Harflex 150	Harchem Div. Wallace & Tiernan	1.28	.5175	318
(See also under dicapryl, diisooctyl, di-2-ethylhexyl, di-n-octyl, and mixed octyl)	—	—			
Di-n-octyl-decyl	Hercoflex 150	Hercules Powder			
Di-n-octyl-n-decyl	DNODP	Monsanto Chemical			
Diphenyl	—	Monsanto Chemical	1.180	.5075	280
Ethylethoxyethyl	Sant. E-15	—			
Higher alcohol	Flexol 810	Carbide and Carbon Chemicals			
"	Flexol 812	—			
Isodecyl	Dinopol IDO	Ohio-Apex Div. FMC	0.975	.305	418

Isooctyldecyl	PX-118	Pittsburgh Coke & Chemical	0.973	.295-.305	418
"	Cabflex ODP	Barrett Div. Allied Chemical & Dye Godfrey L. Cabot			
Isooctyl isodecyl	Darex	Dewey & Almy Chemical Div.	0.97-0.975	.305	418
"	"	W. R. Grace			
"	RC ODP	Montrose Chemical Rubber Corp. of America			
Methylethoxyethyl	Sant. M-17	Monsanto Chemical	1.220	.4275	266.3
Mixed alcohol	Staflax MP	Deecy Products	0.97	.305	409
"	Staflax CP	"	0.98	.29	376
"	Flexol 426	Carbide and Carbon Chemicals	0.9941	.27	—
Mixed diisooctyl, di-n-octyldecyl	Hercoflex 250	Hercules Powder	0.974	.32	400
Mixed phthalate esters	Sant. 601	Monsanto Chemical	0.979	.32	—
"	Sant. 602	"	0.972	.305	—
"	Sant. 606	"	1.012	.287	—
Mixed octyl	Dinopol MOP	Ohio-Apex Div. FMC	0.982	.32	397
N-octyldecyl	Dinopol 235	"	0.975	.335	408
Octyldecyl	Morflex 175	Morton-Withers Chemical	0.971-0.973	.305	418
"	ODP	Hatco Chemical			
Octyl fatty phthalic acid esters	Ohopex Q-10	Ohio-Apex Div. FMC	0.957	.295	—
Others					
Complex phthalate	Staflax KA	Deecy Products	1.04	.36	500 plus
"	Staflax KD	"	1.05	.44	500 plus
Phthalate plasticizer	Morflex 165	Morton-Withers Chemical	0.978	.295	390
"	Morflex 185	"	0.987	.290	362
PHOSPHATES & PHOSPHONATES					
Alkyl aryl phosphate	Sant. 141	Monsanto Chemical	1.090	.34	362
Bis(2-ethylhexyl) 2-ethylhexyl phos- phonate	—	Virginia-Carolina Chemical	0.908	1.65	418
Cresyl diphenyl phosphate	Sant. 140	Monsanto Chemical	1.208	.33	340
"	Celluflex 112	Celanese Corp. of America	1.210	—	—
Cresyl phenyl phos- phate	Kronitex MX	Ohio-Apex Div. FMC	1.195	.33	350
Dibutyl butyl phosphonate	—	Virginia-Carolina Chemical	0.948	1.65	250
Diethyl ethyl phosphonate	—	"	1.025	2.25	166
Tributoxyethyl phosphate	KP-140	Ohio-Apex Div. FMC	1.020	.46	398
Tributyl phosphate	—	"	0.978	.50	266
Tri(2-ethylhexyl) phosphate	TOF	Carbide and Carbon Chemicals	0.9262	.435	434
Tricresyl phosphate	TCP	Monsanto Chemical	1.145-1.166	.33	368
"	—	Montrose Chemical			
"	Kronitex AA	Ohio-Apex Div. FMC			
"	Kronitex I	"			
"	Kronitex K-3	"			
"	PX-917	"			
"	Celluflex 179-A	Pittsburgh Coke & Chemical			
"	" 179-C	Celanese Corp. of America			
"	" 179-EG	"			
"	" GA	"			
"	Lindol	"			
"	Lindol HF	"			
Triphenyl phosphate	—	Dow Chemical	1.268-1.28	.39-.40	326
"	—	Monsanto Chemical			
"	—	Montrose Chemical			
"	Celluflex TPP	Celanese Corp. of America			
Tri(p-tert-butylphenyl) phosphate	Plasticizer 77	Dow Chemical	—	.71	494
Tris (p-chlorethyl) phosphate	Celluflex CEF	Celanese Corp. of America	1.425	.65	285
2-Biphenyl diphenyl phosphate	Plasticizer 5	Dow Chemical	1.20	.315	402
POLYBASIC ACID ESTERS (MONOMERIC, ACYCLIC)					
Adipate, dibenzyl	Morflex 350	Morton-Withers Chemical	—	—	326
" dibutoxyethyl	DBCA	Hatco Chemical	0.993-0.997	.45-.4525	346
" " "	—	Kessler Chemical			
" " "	Adipol BCA	Ohio-Apex Div. FMC			
" di(butoxy ethoxy ethyl)	TP-95	Thiokol Chemical	1.02	.65	435
" dicapryl	Harflex 280	Harchem Div. Wallace & Tiernan	0.915	.43	370

CHEMICAL NAME	TRADENAME	MANUFACTURER	SPECIFIC GRAVITY OR DENSITY	PRICE (\$/LB.)	MOLECULAR WEIGHT
POLYBASIC ACID ESTERS (MONOMERIC ACYCLIC) (Continued)					
Adipate, didecyl	Cabflex DDA	Godfrey L. Cabot	0.915-0.920	.425-.435	426
" "	DDA	Hatco Chemical			
" "	Morflex 330	Morton-Withers Chemical	0.921-0.929	.425-.455	371
" di-2-ethylhexyl	Cabflex DOA	Godfrey L. Cabot			
" " "	Flexol A-26	Carbide and Carbon Chemicals			
" " "	—	Kessler Chemical			
" " "	DOA	Monsanto Chemical			
" " "	Morflex 310	Morton-Withers Chemical	—	—	—
" " "	Adipol 2EH	Ohio-Apex Div. FMC			
" " "	—	Tennessee Eastman	0.926-0.939	.42	314
" diglycol	DGA	Hatco Chemical			
" dihexyl	Harflex 260	Harchem Div. Wallace & Tiernan	0.953-0.957	.4325	258
" " "	—	Kessler Chemical			
" diisobutyl	Cabflex Di-BA	Godfrey L. Cabot	0.918-0.92	.425	426
" " "	—	Tennessee Eastman			
" diisodecyl	Darex	Dewey & Almy Chemical Div.	0.924	.425	392
" " "	—	W. R. Grace			
" " "	DIDA	Monsanto Chemical	0.924-0.93	.425-.455	371
" " "	Adipol XX	Ohio-Apex Div. FMC			
" diisodecyl-octyl	Adipol 810	Ohio-Apex Div. FMC	0.94	.435	384
" diisooctyl	Cabflex Di-OA	Godfrey L. Cabot			
" " "	Darex	Dewey & Almy Chemical Div.	0.914	.48	388
" " "	—	W. R. Grace			
" " "	—	Griffin Chemical	0.915	.445	398.0
" " "	—	C. P. Hall			
" " "	Harflex 220	Harchem Div. Wallace & Tiernan	0.921	.425-.435	398
" " "	—	Kessler Chemical			
" " "	Morflex 300	Morton-Withers Chemical	0.918	.47	398
" " "	Adipol 10A	Ohio-Apex Div. FMC			
" " "	PX-208	Pittsburgh Coke & Chemical	0.923	.47	390
" " "	RC DIOA	Rubber Corp. of America			
" diisooctyl-decyl	Staflax DIODA	Decy Products	0.934	.52	356
" di-n-octyl decyl	Hercosflex 290	Hercules Powder			
" dinonyl	PX-209	Pittsburgh Coke & Chemical	0.91-0.920	.48	413
" dioctyl	—	Barrett Div. Allied Chemical & Dye			
" " "	Good-rite GP-233	B. F. Goodrich Chemical	0.925	.50	300
" " "	—	Griffin Chemical			
" " "	C-497	C. P. Hall	0.918-0.92	.48	412
" " "	Harflex 250	Harchem Div. Wallace & Tiernan			
" " "	Polycizer 332	Harwick Standard Chemical	0.925	.50	300
" " "	DOA	Hatco Chemical			
" " "	PX-238	Pittsburgh Coke & Chemical	0.921	.425-.435	398
" " "	RC DOA	Rubber Corp. of America			
" isooctyl decyl	Cabflex ODA	Godfrey L. Cabot	0.918	.47	398
" " "	PX-218	Pittsburgh Coke & Chemical			
" n-octyl decyl	Adipol ODY	Ohio-Apex Div. FMC	0.923	.47	390
" octyl decyl	Morflex 375	Morton-Withers Chemical			
Azelaate, di-2-ethylbutyl	Plastolein 9050 DHZ	Emery Industries	0.934	.52	356
" " "	—	—			
" di-2-ethylhexyl	Staflax DOZ	Decy Products	0.91-0.920	.48	413
" " "	Plastolein 9058 DOZ	Emery Industries			
" " "	C-497	C. P. Hall	0.925	.50	300
" " "	Morflex 410	Morton-Withers Chemical			
" " "	—	Tennessee Eastman	0.928	.50	300
Azelaate dibutyl "Cello-solve"	C-506	C. P. Hall			
" diisobutyl	3880-A	C. P. Hall	0.918-0.92	.48	412
" diisooctyl	Cabflex Di-OZ	Godfrey L. Cabot			
" " "	Plastolein 9057 DIOZ	Emery Industries	0.925	.50	300
" " "	C-428	C. P. Hall			
" " "	Morflex 400	Morton-Withers Chemical	0.921	.49	412
" di-n-butyl	C-429	C. P. Hall			
" dioctyl	—	Griffin Chemical	1.048	.385	402
Citrate, acetyl tributyl	—	Chas. Pfizer			
" acetyl triethyl	—	—	1.135	.36	318
" acetyl trioctyl	—	—			
" tributyl	—	—	0.983	.39	360
" tricarbitol	Plastoid 831	Colloids			
" triethyl	—	Chas. Pfizer	1.28	.585	540
Fumarate, dibutyl	DBF	Hatco Chemical			
" " "	—	Monsanto Chemical	1.136	.4275	276
" " "	—	—			
" " "	—	—	—	—	228
" " "	—	—			



Fumarate, diphenoxyl-ethyl	Pycal 62	Atlas Powder	1.08	—	356
Itaconate, dibutyl	—	Chas. Pfizer	0.983	—	242
Sebacate, butyl benzyl	Harflex 45	Harchem Div. Wallace & Tiernan	1.004	—	348
" " dibenzyl	Morflex 250	Morton-Withers Chemical	1.05	—	382
" " dibutoxyethyl	Harflex 90	Harchem Div. Wallace & Tiernan	1.055	.88	382
" " dibutyl	Staflax DBES	Deccy Products	0.97	.61	402
" " " "	—	Griffin Chemical			
" " " "	C-392	C. P. Hall			
" " " "	Harflex 40	Harchem Div. Wallace & Tiernan			
" " " "	Polycizer DBS	Harwick Standard Chemical	0.934-0.940	.66-.695	314
" " " "	DBS	Hatco Chemical			
" " " "	Morflex 240	Morton-Withers Chemical			
" " " "	PX-404	Pittsburgh Coke & Chemical			
" " " "	—	Reichhold Chemicals			
" dibutyl "Cellosolve"	C-504	C. P. Hall			
" dicapryl	Harflex 80	Harchem Div. Wallace & Tiernan	0.907	.61	426
" dihexyl	Harflex 60	" "	0.911	.62	370
" di-2-ethyl-hexyl	Staflax DOS	Deccy Products			
" " " "	C-494	C. P. Hall			
" " " "	Morflex 210	Morton-Withers Chemical	0.91-0.917	.61-.63	426
" " " "	Monoplex DOS	Rohm & Haas			
" " " "	—	Tennessee Eastman			
" diisooctyl	C-495	C. P. Hall			
" " " "	Harflex 20	Harchem Div. Wallace & Tiernan			
" " " "	DIOS	Hatco Chemical	0.916-0.917	.61-.63	426
" " " "	Morflex 200	Morton-Withers Chemical			
" " " "	RC DIOS	Rubber Corp. of America			
" dimethyl	Harflex 10	Harchem Div. Wallace & Tiernan	0.986	1.25	230
" dioctyl	C-494	C. P. Hall			
" " " "	Harflex 50	Harchem Div. Wallace & Tiernan			
" " " "	DOS	Hatco Chemical			
" " " "	—	Reichhold Chemicals			
" " " "	RC DOS	Rubber Corp. of America	0.91-0.917	.61-.645	426
" " " "	Darex	Dewey & Almy Chemical Div.			
" " " "	—	W. R. Grace			
" " " "	NL-C20	Griffin Chemical			
" " " "	PX-438	National Lead			
" " " "	—	Pittsburgh Coke & Chemical			
" mixed adipate	Staflax LA	Deccy Products	0.93	.61	410
Tartrate, dibutyl	—	Kessler Chemical	1.091	.64	262

#### MONOBASIC ACID ESTERS (MONOMERIC)

Acetin	—	Kessler Chemical	1.190	.47	134
Diacetin	—	" "	1.178	.47	176
Benzoate, benzyl	—	Montrose Chemical	1.12	—	212
Benzoate, diethylene glycol di-	Benzoflex 2-45	Tennessee Products & Chemical	1.175	.26	314
Benzoate, dipropylene glycol di-	Flexol 77-G	Carbide and Carbon Chemicals	1.127-1.1271	.27-.32	342
Benzoate, dipropylene glycol di-	Benzoflex 9-88	Tennessee Products & Chemical			
Benzoate, ethylene glycol di-	Benzoflex E-60	Tennessee Products & Chemical	—	.60	270
Benzoate, modified polypropylene glycol di-	Plastoflex MGB	Advance Solvents & Chemical	1.129	.35	—
Benzoate, polyethylene glycol 200 di-	Benzoflex P-200	Tennessee Products & Chemical	1.158	.60	408
Benzoate, polyethylene glycol 300 di-	Benzoflex P-300	" "	1.150	.60	508
Benzoate, polyethylene glycol 400 di-	Benzoflex P-400	" "	1.145	.60	608
Benzoate, polyethylene glycol 600 di-	Benzoflex P-600	" "	1.141	.60	808
Benzoate, triethylene glycol di-	Benzoflex T-150	" "	1.168	.60	358
Butyrlin, tri-	—	Tennessee Eastman	1.035	.69	302
Butyl monoesterr	RC B-17	Rubber Corp. of America	0.866	.195	330
Caprate, triethylene glycol caprylate	Plasticizer GC	Harwick Standard Chemical	0.97	market	399
Caprate, triethylene glycol dicaprylate	Eldoplast 45	Eldorado Oil Works	0.965	.575	400
Caprylate, triethylene glycol di-	RC TG-8	Rubber Corp. of America	0.973	.31	406
2-Ethylbutyrate, triethylene glycol di-	Flexol 3GH	Carbide and Carbon Chemicals	0.9946	.44	346
2-Ethylhexoate, 2, 2' (2-ethylhexamide) diethyl di-	Flexol 8N8	Carbide and Carbon Chemicals	0.9564	.355	483

CHEMICAL NAME	TRADENAME	MANUFACTURER	SPECIFIC GRAVITY OR DENISTY	PRICE (\$/LB.)	MOLECULAR WEIGHT
MONOBASIC ACID ESTERS (MONOMERIC continued)					
2-Ethylhexoate, polyethylene glycol di-	Flexol 4GO	Carbide and Carbon Chemicals	0.9892	.325	—
2-Ethylhexoate, triethylene glycol di-	Flexol 3GO Plastoid 871	Carbide and Carbon Chemicals Colloids, Inc.	0.9679-0.968	.53-.6125	402
Laurate, butyl "Cello-solve"	C-311	C. P. Hall	.883	.36	300
Laurate, polyethylene glycol 400 di-	S-1018A	Glyco Products	.99	—	778
Laurate, diethylene glycol mono-	—	El Dorado Oil Works	.960	—	288
Laurate, glyceryl	—	"	.970	—	274
Laurate, polyethylene glycol 400 mono-	—	"	.970	—	756
Laurate, butoxyethyl	—	Kessler Chemical	.882	.375	300
Laurate, butyl	—	Kessler Chemical	—	.375	—
Laurate, methoxyethyl	—	Kessler Chemical	.894	—	258
Myristate, isopropyl	—	Arnold, Hoffman	.849	.535	270
Oleic acid	Ahcolein 810	Arnold, Hoffman	.891	.185-.22	282
Oleate, butyl	—	Arnold, Hoffman	.864-.868	.2325-.38	338
" "	—	Kessler Chemical			
" "	—	Ohio-Apex Div. FMC			
" "	Witcizer 100	Witco Chemical			
" butoxyethyl	—	Kessler Chemical	.885	.355	382
" methoxyethyl	—	Kessler Chemical	.892-.903	.3225-.35	340
" "	Kapsol	Ohio-Apex Div. FMC			
" tetrahydrofurfuryl	Plastolein 9250 THFO	Emery Industries	.928	.3575	366
Oleate, butyl	C-503	C. P. Hall	.865	.26	339
Oleate, butyl "Cello-solve"	C-325	C. P. Hall	.887	.36	382
Others					
Modified phenoxyethyl fatty acid ester	Pycal 170	Atlas Powder	.943	—	430
Blown castor oils	—	Baker Castor Oil	.990-1.03	.205-.235	—
Hydrogenated castor oil	Castorwax	"	.990	.24	932
Refined castor oil	AA	"	.959	.18	926
Coconut oil fraction (mixed esters)	Eldoplast 45	El Dorado Oil Works	.9	.54	450
Glycol fatty acid ester	4141	C. P. Hall	.973	.5575	406
Ester	Harflex 500	Harchem Div. Wallace & Tiernan	.933	.315	—
Pentaerythritol ester of fatty acids	—	Montrose Chemical	—	—	—
Tall oil esters	—	"	—	—	—
Pentaerythritol fatty acid ester	Hercoflex 600 Hercoflex 610	Hercules Powder	.9974 .9943	.42 .42	— —
Stabilized chlorinated fatty acid ester	MPS-500	Hooker Electrochemical	1.19	.21	488
Mixed octyl fatty acid esters	Ohopex R-9	Ohio-Apex Div. FMC	.864	.3525	395
Blown castor oils	—	Pacific Vegetable Oil	—	—	—
Refined coconut oil	—	—	—	—	—
Palmitate, isooctyl	RC O-16	Rubber Corp. of America	.863	.275	368
Pelargonate, butyl "Carbitol"	3497-A	C. P. Hall	.930	.60	302
Pelargonate, butyl "Cello-solve"	3425-A	C. P. Hall	.910	.60	258
Pelargonate, diethylene glycol	Plastolein 9055 DGP	Emery Industries	.966	.28	362
Pelargonate, triethylene glycol di-	RC TG-9	Rubber Corp. of America	.964	.41	438
Ricinoleate, butyl	Flexricin P-3 Staflax BR	Baker Castor Oil Deecy Products	.91-.917	.265-.29	355
" butyl acetyl	Flexricin P-6	Baker Castor Oil			
Ricinoleate, butyl acetyl poly-	PG 16	"	.928	.36	388
Ricinoleate, acetylated methoxyethyl	Staflax IXA	Deecy Products	.911	.35	362
Ricinoleate, cyclohexyl	Staflax AX	"	.97 .93	.325 .43	399 380

Ricinoleate, ethylene glycol mono-	Flexricin 15	Baker Castor Oil	.969	.34	342
Ricinoleate, glyceryl mono-	Flexricin 13	"			
Ricinoleate, glyceryl mono-	Carlisle GMR	Carlisle Chemical Works	.98-.981	.41	—
Ricinoleate, glyceryl mono-	S-1153	Glyco Products			
Ricinoleate, glyceryl triacetyl	Flexricin P8	Baker Castor Oil	.965	.32	1033
Ricinoleate, isobutyl " isobutyl	Flexricin 16	"	.913	.28	352
acetyl	Flexricin 66	"	.928	.3175	388
Ricinoleate, methoxyethyl acetyl	Flexricin P-4C	"	.958	.415	390
Ricinoleate, methyl " methyl	Flexricin P-1	"	.925	.31	310
acetyl	Flexricin P-4	"	.938	.30	346
Ricinoleate, propylene glycol	Flexricin 9	"	.960	.3875	354
Stearate, butoxyethyl " "	—	Kessler Chemical Ohio-Apex Div. FMC	.877-.882	.29-.32	384
" butyl	KP-23	Arnold, Hoffman			
" "	—	Harchem Div. Wallace & Tiernan			
" "	—	Kessler Chemical	.855-.860	.22-.25	340
" "	—	Ohio-Apex Div. FMC			
" "	Witcizer 200	Witco Chemical			
" diglycol	Carlisle DGS	Carlisle Chemical Works	—	—	—
" glyceryl mono-	Carlisle GMS Monoflake	"	—	—	—
" methoxyethyl	—	Kessler Chemical	.877	.325	342
" n-butyl	Staflax Butyl Stearate	Deacy Products	.86	.24	341
" propylene glycol	Carlisle PGS	Carlisle Chemical Works	—	—	—
Triacetin	—	Kessler Chemical			
"	—	Montrose Chemical	1.155-1.16	.37-.40	218
"	—	Tennessee Eastman			

#### POLYETHERS & POLYMERIC

Ether, bis(p-[1,1,3,3-tetramethylbutyl]-phenyl)	Plasticizer 1099	Dow Chemical	.92-.95	.28 plus royalty	394
Ether, modified phenyl polyoxyethylene	Pycal 194	Atlas Powder	1.092	—	—
Ether, phenyl polyoxyethylene	Pycal 94	"	1.120	—	—
Ethylene oxide condensate, polyoxypropylene glycol	Pluronic F68	Wyandotte Chemicals	—	.385	8000
"	Pluronic L44	"	1.05-1.06	.335	2000
"	Pluronic L62	"	1.025-1.035	.335	2000
"	Pluronic L64	"	1.04-1.05	.335	3000
Glycolate, bis(phenyl polyethylene glycol) di-	Pycal 40	Atlas Powder	1.198	—	460
Glycolate, diphenoxyethyl di-	Pycal 60	"	1.24	—	374
Glycolate, modified bis(phenyl polyethylene glycol) di-	Pycal 140	"	1.164	—	500
Others					
Resinous type	Polyco	Borden Chemical Div.	1.15	.34	—
"	Resoflex R-296	Cambridge Industries	—	.48	—
"	Resoflex R-446	"	—	.48	—
"	Resoflex R-451	"	—	.30	—
"	Resoflex R-458	"	—	.40	—
"	Resoflex R-460	"	—	.30	—
"	Resoflex R-594	"	—	.39	—
"	Resoflex R-596	"	—	.32	—
"	Resoflex R-610	"	—	.39	—
Polyalkylene glycol derivative	Flexol B-400	Carbide and Carbon Chemicals	.995	.25	—
Polyester	Flexol R-2H	"	1.055	.59	—
Polyglycol	15-100	Dow Chemical	1.064	.25	—
"	15-200	"	1.053	.25	—
"	E200	"	1.124	.22	200
"	E300†	"	1.125	.22	300
"	E400	"	1.125	.22	400
"	E500M	"	1.200	.255	500
"	E600	"	1.126	.22	600

CHEMICAL NAME	TRADENAME	MANUFACTURER	SPECIFIC GRAVITY OR DENSITY	PRICE (\$/LB.)	MOLECULAR WEIGHT
<b>POLYETHERS &amp; POLYMERIC</b>					
Others (continued)					
Polyglycol	E1000	Dow Chemical	1.117	.29	1000
"	E1450	"	1.210	.3075	1450
"	E2000	"	1.211	.3075	2000
"	E4000	"	1.212	.31	4000
"	E6000	"	1.212	.35	6000
"	E9000	"	1.212	.37	9000
"	P250	"	1.011	.40	250
"	P400	"	1.007	.25	400
"	P750	"	1.004	.25	750
"	P1200	"	1.003	.25	1200
"	P2000	"	1.003	.25	2000
"	P3000	"	1.001	.26	3000
"	P4000	"	1.001	.27	4000
Polyglycol P600 & octyl ether	—	"	.985	.75	600
Polyglycol P600 & methyl ether	—	"	.986	.65	600
Polyglycol P1000 & phenyl ether	—	"	1.008	—	1000
Resinous polyester	Plastolein 9714	Emery Industries	1.075	.37	850
"	Plastolein 9720	"	1.031	.37	850
Polyester	Glyptal 2557	General Electric	1.02	.4425	—
"	Glyptal 2559	"	1.07	.395	—
"	Glyptal 73506	"	1.11	.6975	—
Polymeric	HA-5-A	C. P. Hall	1.06	.805	8000
"	HA-57	"	1.10	.74	7000
"	HA-7A	"	1.15	.58	6000
Polyester	Harflex 300	Harchem Div. Wallace & Tiernan	1.088	.60	—
"	Hercoflex 900	Hercules Powder	1.22	.36	—
"	Morflex P-10	Morton-Withers Chemical	.923	.49	—
"	" P-20	"	.9225	.46	—
"	" P-30	"	.9885	.38	—
"	" P-40	"	.9771	.44	—
"	" P-50	"	—	—	—
Polyether esters	Kessaflex 103	Kessler Chemical	1.006	.405	—
Semipolymeric	NL-F21	National Lead	.918	.395	—
Polymeric	Paraplex G-25	Rohm & Haas	1.06	.79	8000
"	" G-40	"	1.15	.51	6000
"	" G-50	"	1.08	.4025	2200
"	" G-53	"	1.10	.45	3380
"	" G-60	"	.990	.335	1000
"	" G-62	"	.999	.36	1000
<b>EPOXY DERIVATIVES</b>					
—	Admex 710	Archer-Daniels-Midland	.990	.335	1000
—	Admex 711	"	.990	.355	1000
—	Admex 744	"	.909	.43	360
—	Drapex 3.2	Argus Chemical	.89	.44	—
—	—	Montrose Chemical	—	—	—
—	PX-800	Pittsburgh Coke & Chemical	.991-.994	.345	—
—	RC E-S	Rubber Corp. of America	.994	.375	975
<b>HYDROCARBONS &amp; HALOGENATED HYDROCARBONS</b>					
Biphenyl, o-nitro	ONB	Monsanto Chemical	1.203	.13	499
Coumarone-indene	Picco 10	Pennsylvania Industrial Chemical	1.05	.135	600
Ethylene, polychlorotrifluoro	Halocarbon Oils	Halocarbon Products	2.0	12.00	800
Naphthalenes, condensed alkyl	Kenflex	Kenrich	1.12	.26	662
Naphthalenes, mixed amyl	Pentalene 195	Sharples Chemicals	.92-.94	.16	220-260
Others					
Hydrocarbon oil	Cabol 100	Godfrey L. Cabot	1.05	.02	250
Polymeric derived from alpha-methyl styrene	Resin 276-V2	Dow Chemical	1.01	.265	—
"	Resin 276-V9	"	1.04	.265	—
Liquid chlorinated paraffin	Chlorowax 40	Diamond Alkali	1.15	.155	570
Liquid chlorinated paraffin	Chlorowax LV	"	1.13	.175	460
Aromatic hydrocarbon resin	Kenflex A	Kenrich	1.12	.26	662
"	" B	"	1.03	.23	—
"	" L	"	1.01	.26	—
"	" N	"	1.01	.18	—



## OTHERS (Continued)

—	Aroclor 1221	Monsanto Chemical	1.182	—	—
—	" 1232	"	1.266	—	—
—	" 1242	"	1.380	—	—
—	" 1248	"	1.445	—	—
—	" 1254	"	1.538	—	—
—	" 1260	"	1.620	—	—
—	" 1262	"	1.646	—	—
—	" 1268	"	1.810	—	—
—	" 4465	"	1.670	—	—
—	" 5442	"	1.470	—	—
—	" 5460	"	1.670	—	—
—	" 2565	"	1.734	—	—
Alkyl-aryl hydrocarbon	HB-20	"	0.971	.16	—
Mixed isomeric terphenyls	HB-40	"	1.004	.23	—
Heavy oil	1-D	Neville Chemical	1.03-1.06	.065	—
Resinous oil	X-1	"	1.05-1.15	.021-.03	—
—	Nevillac 10	"	1.075-1.1	.39	—
—	Nevillac TS	"	1.07-1.09	.85	—
—	Nevinol	"	1.03-1.08	.20	—
—	Panaflex BN-1	Pan American Refining Chemicals Div.	0.944	.18-24	240
—	Panaflex BN-2	"	0.948	.20-26	240
—	Panaflex EP-1	"	1.058	.05-.09	375
Alkylated aromatic hydrocarbon	Piccocizer R	Pennsylvania Industrial Chemical	0.93	.04-.055	450
"	Aromatic plasticizer 10	"	0.93	0.5-.065	500
"	" 25	"	0.97	"	610
Aromatic hydrocarbon	Piccocizer 30	"	0.98	.055-.07	350
"	Dipolymer Oil	"	0.97	.33-.48	450
"	Dutrex 20V	Shell Oil	1.032	.061	—
"	Dutrex 25	"	1.014	.061	—
Aromatic oil	Philrich 5	Phillips Petroleum Special Products Div.	0.989	.11	—
Aromatic petroleum oil	S/V Sovaloid C	Socony-Vacuum oil	1.05	.0013	230
"	S/V Sovaloid K	"	0.979	.012	—
"	S/V Sovaloid N	"	0.983	.043	—
Naphthenic petroleum oil	S/V Sovaloid L	"	0.898	.056	—
White mineral oil	Gloria	L. Sonneborn Sons	0.875-0.885	—	—
"	Kaydol	"	0.885-0.895	—	—
"	Plandol	"	0.850-0.860	—	—
Polystyrene	Piccolastic A-5	Pennsylvania Industrial Chemical	1.02	.285-.29	800
Terpene	Piccolyte S-10	"	.93	.185-.19	750

## MISCELLANEOUS

Camphor	—	E. I. duPont de Nemours	0.990	—	152
Formal, di(butoxy-ethoxyethyl)	TP-90-B	Thiokol Chemical	0.97	.59	336
Formamide, ethanol	—	Westvaco Chlor-Alkali Div. FMC	1.17	3.00	189
Octadecenyl	Cachalot oleyl alcohol	M. Michel	—	—	265
Propanol, 1,1'-isopropylidenebis(p-phenyleneoxy)di-2-	Resin 565	Dow Chemical	1.085	.39	344
Sulfonamide, N-cyclohexyl p-toluene	Sant. 1-H	Monsanto Chemical	1.125	.50	253
Sulfonamide, N-ethyl p-toluene	Sant. 3	"	1.259	.46	199
Sulfonamide, N-ethyl o-p-toluene	Sant. 8	"	1.190	.43	199
Sulfonamide, o-p-toluene	Sant. 9	"	1.353	.39	171
Others					
Gelled type	—	Allied Asphalt & Mineral	—	.0375-.07	—
—	RB-133	Dow Chemical	1.293	—	—
—	DP-100	E. F. Drew	0.952	—	374
—	DP-200	"	0.985	—	462
—	DP-250	"	1.03	—	914
—	DP-312	"	0.976	—	542
—	DP-316	"	0.951	—	440
—	DP-317	"	0.948	—	496
—	DP-520	"	1.132	—	352
—	SC	"	0.966	—	418
—	Hercoflex 223	Hercules Powder	1.07	.295	—
—	Morflex X-943	Morton-Withers Chemical	0.971	.25	302
Ester	NL-F31	National Lead	0.918	.44	—
Ester	NL-F41	"	0.919	.48	—
Mixed ester	NL-A54	"	0.973	.295	—
—	KP-90	Ohio-Apex Div. FMC	0.910	.45	354
—	KP-220	"	0.949	.31	358
—	Monoplex S-38	Rohm & Haas	0.940	.215	500-600
—	Monoplex S-71	"	0.901	.45	380

# New Snap-Open Sack OPENS EASIER, FASTER



**SNAP-OPEN SACKS** . . . so easy to open that a 10 year-old girl actually outspeeds an experienced hand working with a conventional bag!

## Boost Your Sales With The Bag That Offers Customers Double Economy

Economy number one: Here's a bag that opens so easily even a 10-year-old girl can open it, and this ease of handling means *faster* handling for your customers with more units per day per man!

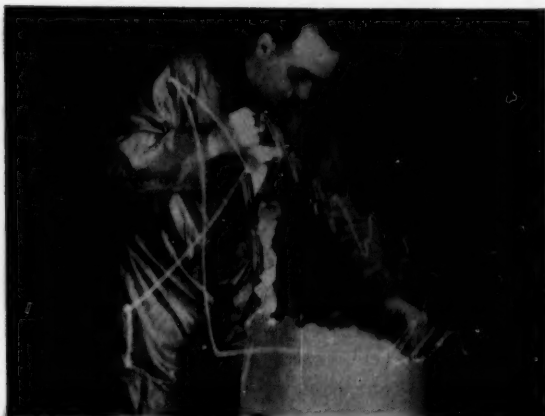
Economy number two: Reduced product spilling means real savings for your customers when you use the new Snap-Open Sack, the bag your customers will begin to demand after your very first shipment.

Yes, you offer multiple advantages to your customers when you bag your product in the Snap-Open . . . advantages that will result in increased sales and customer satisfaction.

Hudson actually went out into the field and asked your customers what they wanted in a multiwall bag. Their answer: a multiwall that would open easily, quickly. The result: the Snap-Open Sack—the bag that opens in an instant, gives you pour-control from a thimble-ful to a hundred pounds, by simply opening the bag a few inches or all the way!

Be among the first in your industry to cash in on this newest multiwall bag which Hudson is pre-selling to customers in farm magazines such as Capper's Farmer and Progressive Farmer, as well as other national consumer publications.

# THAN ANY OTHER BAG



**PULL AND TUG DAYS** of opening bags are over! Actual light tracing photo shows how knife blades and pull-and-tug method (*left*) actually waste both time and product, while easy snap motion opening of new Hudson multiwall saves time and saves product.



**SIMPLE BUT DRAMATIC** demonstration of Snap-Open's *controlled* pouring is seen in these two photographs. With Snap-Open, spilling is at a minimum, pour-rate can be accomplished as desired from a thin stream to a hundred pounds.



Mail this coupon for free folder and information about the Snap-Open Sack. -----

Hudson Pulp & Paper Corp., Dept. CW-4  
477 Madison Avenue, New York 22, N. Y.

Yes, please send further information on Snap-Open Sacks and how I can use this new development to increase my sales.

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ Zone \_\_\_\_\_ State \_\_\_\_\_



AGRONOMY EDUCATION begins with instructing sales team, extends to on-the-spot aid to fertilizer dealer.



## The Magic Word: Agronomy

Imagine, if you will, you're selling chemicals to consumers whom you will likely never meet, who believe only what their own friends tell them and are suspicious of advertising claims, and who almost invariably must borrow funds to buy your product. That's the row the agricultural chemical makers have to hoe.

As a basic ag chem producer, probably no company has put more stress than Spencer Chemical on convincing the farmer of the wisdom of stepping up his farm chemical usage. From the time of its first entry into the nitrogen market back in 1946, Spencer has been plugging the idea that the way to sell ag chems is to identify itself with the farmer's best interests.

Spencer has based its program on research plus education. The magic word in the educational program at Spencer is "agronomy." Agronomy sells nitrogen to farmers the company may never meet. It's the tieline that enables the company—through fertilizer dealers, vocational agricultural teachers, farm bankers, farm press and other friends of the farmer—to reach the ultimate consumer.

Spencer's first step in its agronomy education program was established back in 1946. Discovering that little data existed on the use of nitrogen in the Midwest, the company made grants-in-aid to recognized agronomic research agencies—the land grant colleges.

**Quintuple Goals:** In addition to giving assistance to college and experiment station researchers, the Spencer Agronomy Dept., headed by Iowa State graduate Proctor Gull, has set up this 5-point program:

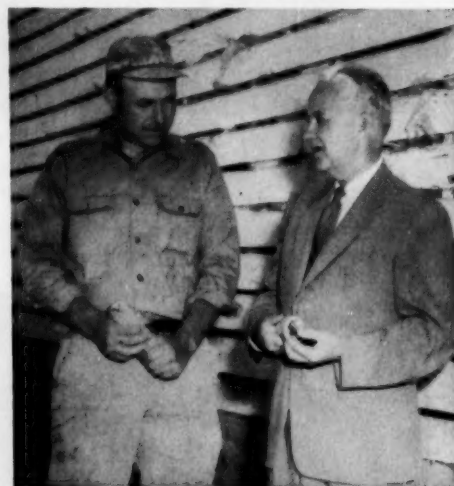
- (1) Keeping company salesmen well informed.
- (2) Educating dealers to be the farmer's best friend.
- (3) Promoting a strong vocational agriculture program.
- (4) Informing farm bankers on matters of farm credit.
- (5) Maintaining a working relation with the farm press and other sources of public information.

(1) The first Agronomy Dept. responsibility is to the salesmen. Each agronomist works closely with one or several salesmen, consults with them frequently as to their major needs.

(2) The fertilizer dealer who retails plant foods in the agricultural community is the key figure in the fertilizer distribution system. He is the man who sees and ultimately sells the farmer. The farmer turns to his dealer for the specialized soil nutrient information he may need as he would turn to his implement dealer for facts about tractors. Since the dealer is often not trained to deal with these problems, he welcomes assistance that equips him to do a better job of selling. Spencer feels that this informed dealer will sell more plant foods for efficient use and thus, quite



VO-AG TEACHERS and students are encouraged by visual aids, contests.



BANKERS are advised and honored for fertilizer credit cooperation.



here it is — the plasticizer with the  
flame-retardance you've been looking for—

# Celluflex<sup>\*</sup> CEF

another product pioneered by Celanese

Celluflex CEF builds exceptional fire-retardancy into a wide variety of plastics and surface coatings—including polyesters, vinyls, cellulose, polyurethanes—and, in all probability, many other polymers and copolymers.

Here, for the first time in commercial quantities, is a plasticizer that provides:



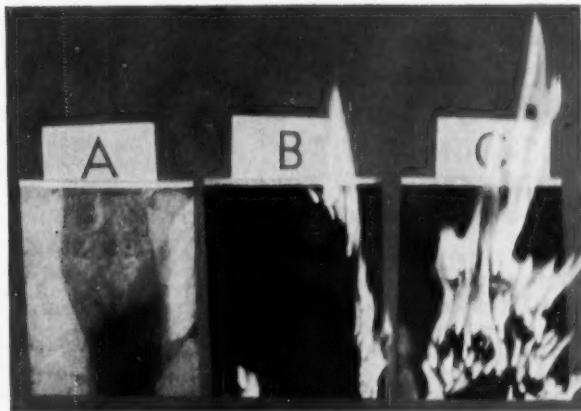
flame-retardance and chemical stability

plus

excellent low temperature properties . . .  
ultraviolet light stability . . .

and a water-white color clear enough for transparent coatings.

We would like you to examine Celluflex CEF in relation to your application. Use the coupon below for test sample and technical data. Celanese Corporation of America, Chemical Division, Dept. 752-D, 180 Madison Avenue, New York 16, N. Y.



**FLAME RETARDANCY TEST.** 3 lacquers were formulated using same basic formula with exception of plasticizer. In Case A, it was Celluflex CEF (tris  $\beta$ -chloroethyl phosphate); Case B, tricresyl phosphate; Case C, dibutyl phthalate.

Lacquers were sprayed on panels, then ignited for 7 seconds. Upon removal of flame, Panel B and C continued to burn but Panel A (Celluflex CEF lacquer) extinguished itself within 2 seconds!



Celanese Corporation of America  
Chemical Division, Dept. 752-D  
180 Madison Avenue, New York 16, N. Y.

If Celluflex CEF can be useful in \_\_\_\_\_  
\_\_\_\_\_ send me test sample and technical literature.

NAME \_\_\_\_\_

TITLE \_\_\_\_\_

COMPANY \_\_\_\_\_

ADDRESS \_\_\_\_\_

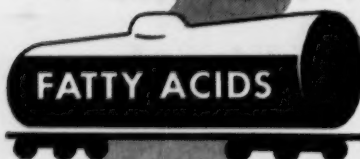
CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_



**Celanese<sup>\*</sup>**  
CHEMICALS

<sup>\*</sup>Reg. U. S. Pat. Off.

# EL DORADO COCONUT OIL



## FEATURE CONTROLLED CHEMICAL COMPOSITION

... so you get better and easier control during processing ... plus a better, more uniform end product.

## SPECIFY EL DORADO FOR

- PURITY
- SERVICE
- UNIFORMITY

El Dorado has specialized in coconut oil products for more than half a century. That's one big reason why you can depend on the performance of El Dorado products in your formulations.

### FATTY ACIDS

CAPRYLIC	ELDHYCO *	CAPRIC
LAURIC	COCONUT	MYRISTIC
	PALMITIC	

### METHYL ESTERS

CAPRYLATE	ELDO 18 *	CAPRATE
LAURATE	COCONATE	MYRISTATE
CAPROATE		PALMITATE

\*T.M. Reg.

For samples and specifications, write  
Dept. W

### Rely on



Main office:  
P. O. Box 599, Oakland 4, Calif.  
Plants:  
Bayonne, N. J., Oakland, Calif.

## DISTRIBUTION . . . . .



NO MEDIUM UNUSED: Press, radio and TV all teach, help sell fertilizer.

likely, more Spencer products.

Some Spencer sales aids: a quarterly trade journal reaching 25,000 dealers; a booklet titled "You Can Do It" that woos the dealer toward more effective merchandising techniques; dealer meetings showing 35-mm. slide films on cotton, corn and pastures, a 16-mm. sound-color fertilizer movie; and personal contacts. All are pitched to carry the Spencer story through the dealer to the farmer. Always the emphasis is on sound farming practices—not on a specific product.

(3) One of the most extensive agronomy activities is Spencer's work in vocational agriculture. Cooperating with vo-ag teachers in the rural high schools in a nine-state area, the company promotes an Efficient Corn Growing Program. A booklet, "Five Tested Steps to Maximum Profit Corn," encourages the farm youngster to grow an acre of corn on a usual-practice basis and an acre following the directions in the booklet. The three best corn growers in each state are honored by Spencer. Emphasis is on assisting the vo-ag teacher in his job of disseminating fertilizer education.

Sets of 35-mm. slides with a script and a fertilizer-use movie are other gimmicks which feed the teacher's interest in plant nutrients. Over 200 visual aids are circulated to the teachers in Spencer's market area. Here, as in all phases of the agronomy program, the conviction is strong that any assistance given to promote the improvement of farm education will ultimately improve Spencer's market position.

(4) Spencer believes that the farm banker (CW, July 10, '54, p. 22) is a pivotal figure of the farm community. To him the farmer turns for the financial resources to meet his operating capital needs. Often, the operating money for fertilizer will have to be loaned by the banker before the farmer can make the purchase.

The Spencer agronomy and advertising sections have cooperated, for example, in a program to recognize "Distinguished Farm Bankers." These bankers, selected by their statewide banking colleagues, have been referred to as model examples of what positive and constructive influence a good banker can be in improving the standards of his farm community. So far, Distinguished Farm Bankers have been elected in 12 states.

(5) The agricultural fourth estate wields a large influence with the farm audience. A Spencer agronomist spends as much time as possible with farm journalists, other reporters.

**Bigger Pie:** Despite alarmist predictions of a temporary oversupply of ammonia and other nitrogen fertilizers, Spencer feels certain that its long-term policy of increasing the size of the agricultural chemical pie (and, concomitantly, Spencer's piece) will continue to pay off. Concerning Spencer's share, Vice-President Joe Culpepper declared: "Our salesmen will meet the challenge of getting a fair cut of the pie, large or small."

Having seen a 10-fold increase in Midwest farm chemical use over the past eight years, the company is confident that the magic of the word "agronomy" will continue.

For better quality and performance  
in a world of products and processes...

## REYNOLDS *aluminum* CHEMICALS

A RANGE OF GRADES AND PARTICLE SIZES OF THESE CHEMICALS IS AVAILABLE. Samples and more information will be sent on request. Call the nearest Reynolds Sales Office, listed under "Aluminum" in your classified telephone directory or write Reynolds Metals Company, 2569 South Third Street, Louisville 1, Kentucky.

PRODUCT	USES	DESCRIPTION
Commercial, Organic Free Alumina Trihydrate	petroleum cracking catalysts ceramic glazes and enamels aluminum sulphate or alum liquid aluminum chloride	A pure, snow white hydrated alumina, free from contaminants. A low-cost source of soluble alumina.
Low-iron, Organic Free Alumina Trihydrate	iron-free alum high quality glassware iron-free catalysts	A specially purified hydrate for improved low-iron end products.
Reynolds Activated Alumina	drying liquids and gases catalyst carrier defluoridation	Dries to lowest dew points of any commercial desiccant. It is inert, easily reactivated, non-deliquescent and will not swell or disintegrate.
Calcined Alumina, Metallurgical Grade	high grade abrasives refractory compounds enamel frits and glazes	High purity and consistent composition. 80% of alumina is in crystalline form of alpha alumina.
Calcined Alumina, Ceramic Grade	kiln furniture chemical porcelain insulator bodies whiteware tile bodies and saggars ceramic stains	Specially processed for maximum consistency and minimum shrinkage.
Aluminum Powders	reducing agent production of aluminum compounds paints explosives	A wide variety of flake, powders and pastes are available.
Cryolite and Aluminum Fluoride	ceramics insecticides fluxes	Highest quality synthetic products.

See "Mister Peepers", starring Wally Cox,  
Sundays on NBC-TV

# REYNOLDS CHEMICALS

FROM THE MAKERS OF REYNOLDS ALUMINUM

# THINK of Snell

**When You Think of  
Research Facilities  
Without Capital Investment**

When you require specialized  
"Know-how"

When you have technical  
problems

There is no cost or obligation  
in conferring with

"Research Headquarters"

**Foster D. Snell, Inc.**  
RESEARCH LABORATORIES  
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WAtkins 4-8800



**Pyrethrum?  
Allethrin?  
ask  
MGK**

As acknowledged pioneers and recognized authorities in the correct use of pyrethrum, allethrin and their most effective synergists, MGK 264 and piperonyl butoxide, we offer standardized concentrates, extracts, dusts of guaranteed uniformity.

If your aerosols, sprays, or dusts include the use of the powerful, safe and spectacular knock-down agents, pyrethrum and allethrin, send your inquiry today. All requests for information answered by qualified authorities. Write.



**M E LAUGHLIN  
G ORMLEY  
K ING Company**

1713 S.E. Fifth Street • Minneapolis, Minnesota

## DISTRIBUTION . . . . .



ALL FOR NYLON: Barrett's Chesterfield, Va., plant rests its future on . . .

## Selling a Modification

When several companies are already offering an established chemical, a newcomer often faces a stiff problem in getting started. Nevertheless, there are ways for the newcomer to jump the sales hurdle. One reliable method: offer a special variation of the product made by the other firms.

Barrett Division of Allied Chemical & Dye Corp. represents a case in point. Barrett is now leaping into nylon—a domain once the exclusive property of Du Pont. And to overcome a late start, the firm is offering a modified type. Dubbed Plaskon nylon 8200, the product's sales appeal lies chiefly in these properties:

- High molten viscosity. This permits blow-molding, greatly reduces nozzle and joint leakage problems. Conventional nylon's fluidity at working temperatures produces serious containment problems.
- Controllable crystalline structure. This property allows the molder to tailor the physical properties of the Plaskon nylon (in thin sections) to specific needs. The same crystalline structure also prevents decomposition with attendant gas liberation during molding and extruding, thus largely eliminating voids.

**Sales Push:** Currently, Barrett will center its nylon sales effort on molding applications rather than textiles. Nylon molding, in Barrett's estimate, is now wide open for expansion.

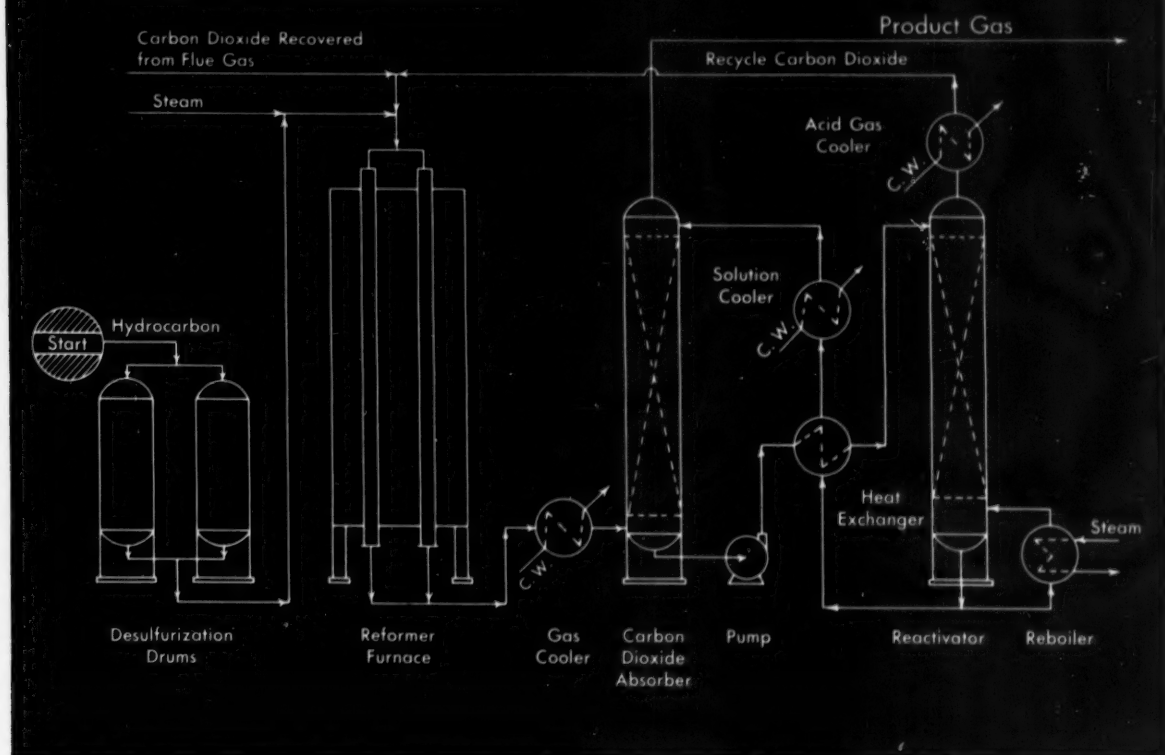
In its push on the molding applications, the company's thermoset operations should help considerably. Barrett figures that between 65-85% of its resins customers also consume thermoplastics. To this sizable quantity of "ready-made" contacts, the firm can add the interest generated by its traveling industrial designer. For the past two years he has talked up Plaskon nylon to the industrial design trade. Now salesmen will carry on, solicit design and engineering groups. (Barrett



**BARRETT'S ELLIS:** Blow-moldable nylon—"a significant development."



# OXO PROCESS SYNTHESIS GAS



## GIRDLER hydrogen-carbon monoxide plants give wide range of mixtures

THE FLOW CHART shows the design of a plant for producing synthesis gas for the "Oxo Process" used in the production of aldehydes and high molecular weight alcohols. A wide range of compositions is obtainable with Girdler synthesis gas plants . . . the ratio of hydrogen to carbon monoxide can vary from 4:1 to 1:9, to suit your requirements.

Girdler assumes complete responsibility for all phases of design, engineering and construction of these plants. Why not take advantage of Girdler's experience for *your* processing facilities. Call the nearest Girdler office.

GIRDLER DESIGNS processes and plants

GIRDLER BUILDS processing plants

GIRDLER MANUFACTURES processing apparatus

### GAS PROCESSES DIVISION:

Chemical Processing Plants	Nitric Acid Plants
Hydrogen Production Plants	Sulphur Plants
Hydrogen Cyanide Plants	Acetylene Plants
Synthesis Gas Plants	Ammonia Plants
Carbon Dioxide Plants	Ammonium Nitrate Plants
Gas Purification Plants	Hydrogen Chloride Plants
Plastics Materials Plants	Fertilizer Plants
Catalysts and Activated Carbon	

The **GIRDLER** Company

A DIVISION OF NATIONAL CYLINDER GAS COMPANY  
LOUISVILLE 1, KENTUCKY

GAS PROCESSES DIVISION: New York, San Francisco.  
In Canada: Girdler Corporation of Canada Limited, Toronto



Florida's new Industrial Information Kit is yours for the asking. Ten convenient folders containing basic facts about Florida's industrial opportunities packaged in a tabbed file-size cover. You'll need this information as a guide before deciding on any site for new plants, plant relocation, branch offices or warehouses.

Write: State of Florida, Industrial Development Division, 3416D Caldwell Building, Tallahassee, Florida.

**Folder Subjects:**

**MARKET • NATURAL RESOURCES  
EDUCATION & CULTURE • POWER  
RESEARCH • HEALTH & CLIMATE  
GOVERNMENT & TAXES • WATER  
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Plan national sales conventions, sales conferences and state and regional meetings for Florida. Exceptional facilities for any type of meeting. Get double value... successful meetings in delightful surroundings plus colorful recreational activities.

*The Governor of Florida and his  
Council for Industry & Commerce  
cordially invite you to investigate  
the special opportunities  
Florida offers Industry*



**you'll always  
do better in**

**Florida**

**DISTRIBUTION . . . .**

plans to expand its sales force to the point where it will be possible to double the present number of contacts.)

What market pattern Barrett's nylon will assume is anyone's guess right now. But it is expected that the nylon will find a place in gears, bushings, cams, wire insulation, valves, instrument housing, aircraft, motor vehicles (lube systems, ball joints, etc.), textile machinery, hardware, appliances, and consumer goods. Currently, for example, nylon bottles are one potential use for resin.

Barrett's plastics and resin sales director Carleton Ellis, Jr., is confident that the specific properties of the nylon variant will result in hefty sales; this confidence is backed by the company's multimillion-dollar investment in the project. But it will take a lot of hard selling to establish Plaskon nylon's place among the well-established thermoplastics.

**Ready for Reference:** "Molybdenum Chemical Bulletins" lists brief descriptions of molybdenum chemicals available from Climax Molybdenum Co., New York City.

- Hexachlorophene is the subject of a revised bibliography of some 136 scientific and trade articles, plus foreign and domestic patent abstracts. Sindar Corp., New York City.

- Revised edition of "How To Merchandise with Corrugated Boxes" is now available from Hinde & Dauch, Sandusky, O.

- How to pack and ship plastics most economically is discussed in the latest issue of Monsanto's Business Executive Series. Check lists include: container design, load preparation, and over-packaging; discussions of classification rates, common carrier regulations, freight forwarding and warehousing. Monsanto Chemical Co., Plastics Div., Springfield, Mass.

- Polyvinyl acetate polymers—booklet gives data on characteristics and possible uses. Dewey and Almy Chemical Co. (Cambridge, Mass.).

- The Becco Chemical Division, Food Machinery & Chemical Corp. (Buffalo, N.Y.) offers two bulletins, "Last Stage Peroxide Bleaching of Alkaline Pulp" and "Action of Silver Catalyzed Persulfate on 1, 2-Glycols." "Peroxide Bleaching" includes data on process engineering, brightness, aging, and several types of bleaching. "Catalyzed Glycols" reports informa-



# TRONA

Is a Basic Producer of these Chemicals Indispensable to Industry and Agriculture

**BORAX**  
**POTASH**  
**SODA ASH**  
**SALT CAKE**

**LITHIUM CHEMICALS - BROMINE CHEMICALS**

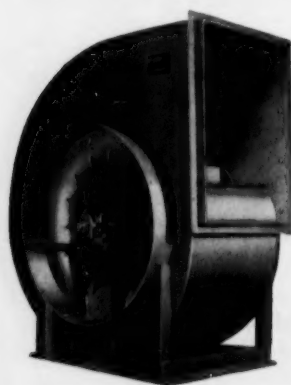
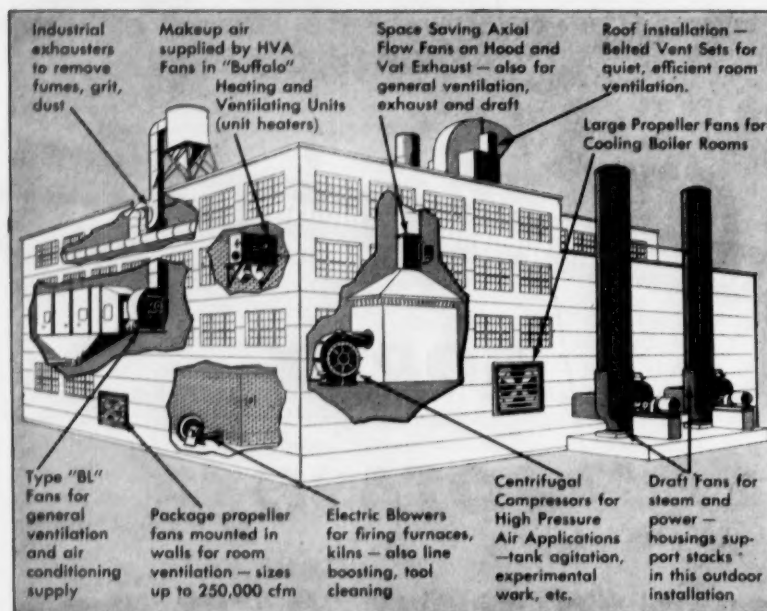
and a diversified line of specialized  
Agricultural, Refrigerant and  
Industrial Chemicals



**American Potash & Chemical Corporation**

Offices • 3030 West Sixth Street, Los Angeles 54, California  
99 Park Avenue, New York 16, New York

# AIR... BREATH-OF-LIFE FOR THE PLANT!



The "Buffalo" Type "BL" Limit-Load Ventilating Fan. Specified for many of the industry's largest ventilating and air conditioning jobs, it is the finest fan we have ever offered. Available in closely graduated capacities from 1000 cfm to 500,000 cfm. Write for Bulletin F-100 for full details.



## BUFFALO FORGE COMPANY

189 BROADWAY

BUFFALO, N. Y.

*Publishers of "FAN ENGINEERING" Handbook*  
Canadian Blower & Forge Co., Ltd., Kitchener, Ont.  
*Sales Representatives in all Principal Cities*

VENTILATING    AIR CLEANING    AIR TEMPERING    INDUCED DRAFT    EXHAUSTING  
FORCED DRAFT    COOLING    HEATING    PRESSURE BLOWING

### ... supplied efficiently by "Buffalo" FANS industry's choice for 78 years

Whatever your product, air goes into it! The air that makes workers more alert and productive—the air that gives you efficient combustion—the air that's used to remove undesirable substances—the air you warm with or cool with—is your plant's breath-of-life.

Above are just a few of the ways in which "Buffalo" fans help a plant to breathe. There's a fan in this complete line for any job you may have for air. And it's well to remember that all makes of fans are *not* alike. There's a great deal to the science of making a fan that will give you permanently good performance. From our 78 years, we know what's practical and what isn't—what must go into a fan. We call it the "Q" Factor\*—the "extra" that makes the user glad he specified "Buffalo".

*\*The "Q" Factor—the built-in Quality which provides trouble-free satisfaction and long life.*

## DISTRIBUTION . . . .

tion on peroxide reaction to produce cleavage products, aldehydes and ketones.

- A just-initiated monthly survey covering manufacturers' shipments of converted flexible packaging products is in the mill. Sponsored jointly by the National Flexible Packaging Assn. and the Business and Defense Services Administration, this periodic checkup of the \$300 million flexible package products industry is to provide statistics to aid production and sales planning.

- Acrylo-news (No. 2)—additional bibliography on acrylonitrile uses and technology. American Cyanamid Co., Petrochemicals Dept. (New York City).

- Aminoethyl ethanolamine—4-p. technical brochure describes physical and chemical properties, shipping sizes, specifications, and suggested uses. Carbide and Carbon Chemicals Co. (New York City).

- Selection of salesmen—book covers recruitment, selection devices, organization and administration, problems of program construction, and salesmen and job. American Management Assn. (New York City).

- Aluminum bottles—leaflet describing line of imported aluminum bottles for oils, chemicals and pharmaceuticals. Basic Material Supply Co. (New York City).

- Recommended specifications for containers and pallets—covers round and oblong cans, drums, shipping cases and expendable pallets. Complete with diagrams, tables and text. Packaging Institute (New York City).

- Southern Preferences for Drugs and Toiletries—includes statistics on regional purchasing likes for selected products arranged by rank and company total. Farm and Ranch Publishing Co. (Nashville, Tenn.).

- Central Atlantic States' Directory of Manufacturers—sixth (1955) edition, listing over 10,000 producers, 30,000 executives, and 2,000 product headings with company listings. T. K. Sanderson Organization (Baltimore).

**Explosives Regulation:** The South Carolina state legislature is now weighing a bill designed to limit the maximum load that could be carried on state highways to 5,000-lb. lots. The law would not affect railroad shipments nor apply to the federal government.



## Louisville Method

# how **BIG** should a dryer be?

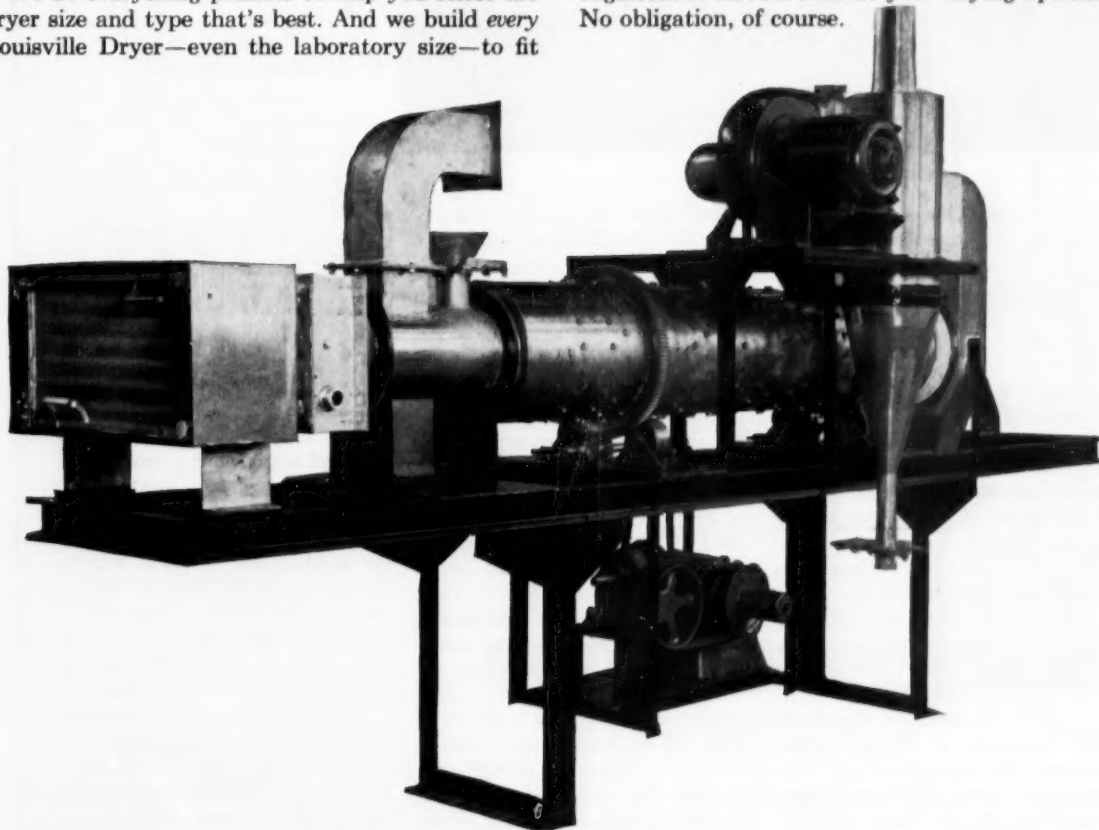
"Baby" Louisville Dryers do a man-sized production  
job for chemical firm

A large chemical firm has twice bought small, laboratory-size Louisville Dryers to serve as pilot plants for new materials. In both cases, their engineers were amazed to find the pilot dryers were producing sufficient quantities to supply the market!

We do everything possible to help you select the dryer size and type that's best. And we build *every* Louisville Dryer—even the laboratory size—to fit

the job, and to give years of satisfactory performance at rock-bottom maintenance cost.

Let Louisville's 53 years of drying experience, spanning thousands of installations for all types of industry, work for you. Why not ask one of our engineers to have a look at your drying operation? No obligation, of course.



LOUISVILLE DRYING MACHINERY UNIT

### GENERAL AMERICAN TRANSPORTATION CORPORATION

Dryer Sales Offices: 139 So. Fourth Street, Louisville 2, Kentucky • 380 Madison Ave., New York 17, New York

General Offices: 135 So. LaSalle Street, Chicago 90, Illinois

In Canada: Canadian Locomotive Company, Ltd., Kingston, Ontario

OFFICES IN ALL PRINCIPAL CITIES

target

## Brake for Spreading Decline



Only recently have the chemical industry and agricultural scientists begun to unite against the soil pests called nematodes—now regarded as among the world's most widespread problems (CW, Jan. 29, p. 83).

And while soil scientists say nematodes probably cause more damage than do insects, the Florida citrus grower can be far more specific, can point to the 6,000 acres of groves put out of production by nematode-caused Spreading Decline. Nematodes yearly cost him \$12 million.

Because of the inroads made by Spreading Decline in recent years, Florida growers have pitted their soil experts against the enemy. At the citrus Experiment Station of the University of Florida (Lake Alfred), six researchers and their assistants have this year been joined by 10 U.S. Dept. of Agriculture scientists in the search for means to defeat Decline.\*

Prime job ahead is testing new

\* Considering that there are probably not more than 30 nematode specialists in this country, the Florida studies show how important Decline is regarded.

chemicals—a slow prospecting job. But the payoff could well be a bonanza for the producer of a suitable nematode-control product. Not only would such a compound be useful for the Sunshine state's 474,216 acres of citrus—it might likely prove useful against the vast number of other soil pests whose ravages are just being appreciated.

**Uncertain Enemy:** Although Spreading Decline has been known in Florida since 1926; it was not until 1953 that its cause was determined by Ross Suit and Ernest DuCharme at Lake Alfred. They proved the guilt of a microscopic worm called the burrowing nematode† (*Radopholus similis*).

Progress of Decline is slow (trees are infected for a season or more before Decline effect shows) but it is virtually unstoppable. Growers have doused soil with everything from ammonium sulfate and sulfur to parathion and chlor-

† This nematode has been known for some 50 years, but Spreading Decline is the first specific plant ailment traced to it here. Commonly known are several other nematodes: Root knot, a problem in the South on nearly every plant; meadow nematode, a country-wide pest; golden nematode, currently a foe of Long Island potato growers.

dane. Infected groves can so far be "cured" only one way:

Infested trees are pulled out, roots and all, as are seemingly healthy trees bordering the Decline area. The bare soil is then treated with D-D (dichloropropene-dichloropropane) to an 8-10-ft. depth and left fallow for two or three months. After that, new seedlings must be put out. In all, the cost is about \$450/acre (D-D cost alone is about \$100), not including loss until the new trees bear.

**Rugged Outline:** This is how Ross Suit outlines the properties of an ideal Spreading Decline nematocide:

- It is nontoxic to plants—and to the grower applying it.
- It can be applied easily, without disturbing tree roots, and preferably mechanically.
- It will penetrate soil to an 8-10-ft. depth.
- It will last a long time—a year at the least.

Recently marketed V-C 13 Nematicide (made by Virginia-Carolina Chemical Corp., Richmond, Va.) appears to hold considerable promise for killing the burrowing nematode without harming the plant (V-C 13 is okayed now for turf and ornamental plants). Shell OS-1897 is also under close scrutiny.

Still, Suit points out, these aren't the final answers: V-C must be hand-applied or roots will be disturbed; OS-1897 seems to slow plant growth. And no chemical can yet save a plant that has been infected (search for a suitable chemotherapeutant is being extended).

Thus, there remains a challenge—and the burrowing nematode is only the first target in Florida's citrus lands. Research has recently shown at least nine other nematodes infecting citrus, and they'll have to be dealt with eventually. Spreading Decline is more than a target—its defeat will be a guidepost pointing the way to chemical control of many other soil pests.

...for low ash where purity pays  
and smoothness sells...

## SWIFT'S STEARIC ACID

has less than 10 parts per million

How much ash is that? Ten red dots in the center of a page six times this size would give you some idea.

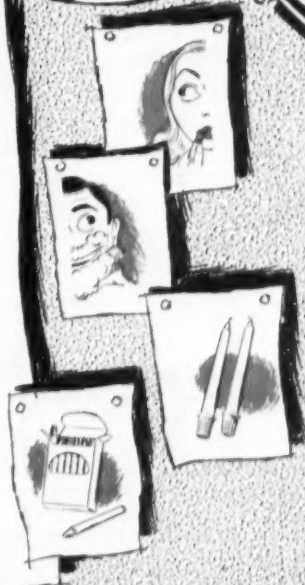
A natural enemy of lipsticks, lathers and lotions—crayons, candles and cosmetics, ASH can make shaves raw, candles smoke, and crayons scratch. To be a good basic material for all these products, stearic acid should have the lowest possible ash content.

Because the ash content is so low our laboratory uses six times the normal weight of sample to get an accurate ash measurement on Swift's Stearic Acid.

Low ash content is no accident, at Swift & Company's modern plant in Hammond, Indiana. The plant is constructed of metals chosen to prevent metallic contamination. Only the better suited grades of raw material are selected from the wide variety available to Swift & Company. Through a unique low temperature solvent process ash, impurities, and color bodies are removed. Every lot is thoroughly checked for specifications and maintained under strict quality control.

Remember, a low ash is a measure of purity and Swift's Stearic Acid is well below the most rigid customer requirement of 10 parts per million. So if purity pays and smoothness sells in *your* business, here's a sound business offer: Write for details on a trial order of Swift's Single, Double or Triple Pressed Stearic. Try it in your plant, on your equipment. We think you'll agree that...

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# SPECIALTIES . . . . .

## Soap Bacteriostat Line-up

Product	Chemical Name	Drum Cost	Sources
Anobial	N-(3,4-dichlorophenyl)-S-chloro-salicylamide	\$3.25/lb.	Firmenich Inc.
Bithionol	2,2'-thiobis (4,6-dichlorophenol)	\$1.45/lb.	Monsanto
Actamer			Hilton-Davis
Lorothidol			
TBP			
Captan	N-trichloromethylmercapto	\$3./lb.;	R. T. Vanderbilt
Vancide 89	4-cyclohexene-1,2-dicarboximide	crystallized, \$5/lb.	
D.C.M.X.	2,4-dichloro-sym.-m-xylene or (2,4-dichloro-3,5-dimethylphenol)	\$1.35/lb.	Ottawa Chemical Co.
Hexachlorophene	2,2'-methylenebis (3,4,6 trichlorophenol)	\$1.95/lb.	Sindar Corp.
AT-7			
G-11			
P.C.M.X.	p-chloro-methylxylene	\$1.35/lb.	Ottawa Chemical Co.
TMTD	tetramethyl thiuram disulfide	\$1.15/lb.	Du Pont
Puralin			Goodrich Chemical Sharples Monsanto

## Bonanza in Bar Soaps

Degerming additives for toilet soaps boom to a \$2-2.5-million annual business. An estimated one-fifth of bar soap sales now are of bacteriostat-fortified products.

Hexachlorophene and TMTD\* are tops, volumewise, of a half-dozen degermers currently offered.

But Colgate's current test-selling of an antiseptic-treated Palmolive could presage hefty sales of bithionol.

Colgate has reached the stage now where it can't keep its interest in bacteriostatic soaps concealed. In Harrisburg, Pa., Topeka, Kan., and Madison, Wis. it's currently test-marketing a new form of Palmolive fortified with bithionol. To the soap industry, the move has dual significance:

- It's the most positive move of any of the major soapers (outside of Lever, of course, with its Lifebuoy) to market a degerming toilet soap.
- If Colgate goes all out with bithi-

\* Tetramethyl thiuram disulfide.

onolized Palmolive, it could boost bithionol into the 0.5-million-pounds-a-year class—a position now held only by hexachlorophene and tetramethyl thiuram disulfide (TMTD).

**Deodorant Wunderbar:** There's no secret about what stirred Colgate's interest in adding a degermer to Palmolive: it's Dial Deodorant Soap, made by Armour and Co., which has proved to be a marketing wonder—in less than a half-dozen years, it has climbed to a leading place in toilet bar sales (poundage), and to the top

spot, dollarwise, most authorities agree.

Further testifying to consumer's acceptance of the bacteriostat soaps is last year's sales jump for Lifebuoy—23%—the largest in the industry. It was the first full year in which Lifebuoy had its new deodorant ingredient, Puralin (or TMTD).

In fact, sales of bacteriostat-boosted soaps now probably total at least a fifth of the toilet bar sales. They're estimated to consume 1.5-2 million lbs. year of the antiseptics, valued at \$2-2.5 million. (Soap bars are far and away the largest single consumer of the degermers.)

**Market Temptation:** Naturally, no market of that size is going to any one or two companies without a fight. Within the past year or so, a number of degermers for soap have been offered (*see chart*)—but only a few have been chosen in any real quantity.

Hexachlorophene, Sindar Corp.'s product tradenamed G-11, is still



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## **SPECIALTIES . . . . .**

rated top seller—it's in Dial as well as a number of other toilet soaps (Manhattan Soap Co.'s Protex is one of the newest). TMTD is probably No. 2 by virtue of its use in Lifebuoy (it has greater sales, however, in two other areas of industry). Bithionol can likely reach big-time if Colgate decides to swing over entirely to deodorant Palmolive.

Of the other hopefuls, captan is currently in Crystal Soap & Chemical Co.'s (Philadelphia) Crystan Liquid Soap; P.C.M.X. is in Essential Chemical Co.'s (Milwaukee) Dermox. D.C.M.X. and Anobial are not currently used in soaps in this country, although Anobial is said to be incorporated in some cosmetics and D.C.M.X. in washing compounds.

**Peroxide Twist:** A new and ingenious approach to making antiseptic soaps has been suggested by Becco Chemical (division of Food Machinery & Chemical Corp.). By treating molten lauric acid with 90% hydrogen peroxide, perlauric acid (a stable, waxy solid) is formed; it seems to combine detergent qualities with a germicidal activity superior to that of sodium laurate.

Becco emphasizes that the work is still experimental, and full data about degerming on human beings, manufacturing techniques, costs, etc., aren't available yet. The perlauric soap recalls products of the '30s—soaps with metallic peroxide additives (such peroxides bleach the soap beautifully, but their antiseptic ability is questionable).

Until the peroxide soap is fully studied, most soapmakers are going to stick with antiseptic additives. In some cases, this involves licensing—G-11 soaps must be made under licensing from Sindar, for example. Although Monsanto recently got a patent for an antiseptic soap made with a halogenated quinoline and a tetra-alkyl thiuram disulfide, there is no license required for use of TMTD.

**Slow Start:** Considering the success of bacteriostat soaps now, it is difficult to understand the reluctance with which soapers initially began incorporating antiseptics in toilet soaps. Although G-11 was readily accepted by soapmakers for specialty soaps (such as for physicians' use), Sindar admits it had a tough job getting anyone to try it in a toilet cake for the home.

Then Armour, seeking to launch a bar soap, worked out its "deodorant" pitch for Dial, and soon found itself with a galloping success.

Apparently the key was the avoidance, in most advertising, of emphasis, or reference to health and medical use. Lever wryly admits that since the happy days of 1936, when Lifebuoy was the top-selling bar, it had dropped alarmingly in popularity. Apparently the cresylic odor, and the health angle of promotion, had lost its appeal. In launching the new Lifebuoy, Lever has tried hard to "get Lifebuoy out of the locker room," make it appeal more to women. (During the transition period of Lifebuoy, when cresylic acid was dropped, Lifebuoy with Puralin was simply a newly scented soap, with no bacteriostat. Later, TMTD was added, and to it was transferred the tradename Puralin.

**Out of the Garden:** Although hexachlorophene was the result of prolonged search for a good bacteriostat, some of the other degermers have achieved soap application indirectly.

The search for many of them didn't start in earnest until Dial had demonstrated the existence of a big market for the special soaps. Then, a host of firms began going back over compounds that might do a job similar to hexachlorophene's.

Curiously, two of the currently offered products have agricultural backgrounds. TMTD, for example, is the active component of such seed disinfectants as Arasan and Thiram. It also finds a major market in the rubber industry as an accelerator\*—both outlets are probably larger now for TMTD than is soap. Captan, too, got its initial start as a plant fungicide.

Bithionol, pushed by Monsanto (as Actamer) for soap use, is not the only degermer Monsanto sells—TMTD is also a Monsanto product, although it's not actively promoted by that firm for soap use. Hilton-Davis, with its Loro-thidol (also bithionol), saw textile fungicide applications besides soap uses.

**Two Ways to Test:** To prove the efficacy of the degermers, several techniques have been evolved. Germ counts of wash water, taken over a several-week period, is one of the commonest ways to show how popu-

\* A related compound, tetraethyl thiuram disulfide, is used in antabuse, the drug for alcoholism.

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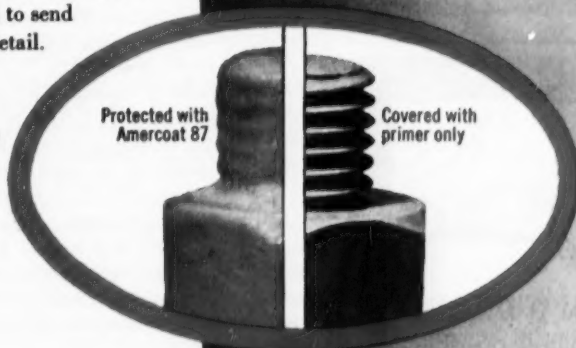
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## SPECIALTIES . . . . .

lation of skin bacteria has been decimated. Another method involves examining test personnel to see if their body odor has actually been reduced.

There has been some quibbling about the interpretation of test results in the germ count programs, largely between makers of rival bacteriostats. Nonetheless, both test methods provide pretty convincing evidence that the degermer soaps are superior to untreated soaps in lowering skin bacteria count and odor levels.

Experience has borne out the facts that it is neither difficult for soap makers to include the bacteriostats in their products nor difficult for them to write off the cost of the additives by charging slightly higher prices for the soaps. Dial, for example, is priced considerably above conventional soaps; and Lifebuoy, whose price was upped ½¢ per bar when TMTD was added, has gained sales steadily.

Bacteriostats have proved a boon to soap sales. So far, only Lever, of Soap's Big Three, has benefitted greatly by the public's demand for deodorant soaps—and that's a point degermer makers are making to soap producers of every size.

**Fly-Kill Test:** A control solution for testing insecticides is available from the Chemical Specialties Manufacturers' Assn. To be used with the Peet-Grady test method, the solution rates fly-killing properties against an industry standard, is priced at \$6 for six 6-oz. bottles. Covering all oil-base contact insecticides except high-viscosity cattle sprays, the test will be official until 1957.

**Thicker Latex:** Acrysol G-110, Rohm & Haas's new thickener for synthetic latices, is 3-20 times more effective in low concentrations than thickeners now available, the company says. An ammonium polyacrylate solution, Acrysol is suggested for use with some of the following types of latices: butadiene-styrene, unplasticized styrene, vinyl chloride, and vinyl acetate.

**Analyses, Anybody?** Over 750 chemical specialty analyses are listed by the Chemical Specialties Research Laboratories' (New York) 1955 bulletin. Also listed: complete production information on eight cleaning and polishing products and an analyses-of-the-month service.

**Neat but Not Greasy:** Cosmetic people may be interested in some new distilled acetylated monoglycerides said to be free of greasiness. Distillation Products Industries (Rochester, N.Y.) offers these glyceride variations in two forms: an easily emulsified white solid, and a clear, nearly colorless, liquid miscible with castor oil. Both are safe for cosmetic use.

**Bulletins:** Among the most recent:

- American Alcolac (Baltimore) has a new product information booklet on its nonionic surface-active agents, Siponics. Three new Siponics—a tall oil ester, an alkylphenol ether, and a branched chain alcohol ether—are described in the booklet.

- Claremont Pigment Dispersion Corp. (Brooklyn) has just published technical data on its K series of color pastes for vinyl plastisol compounding. The bulletin is tagged No. 140.

**Broad-range Herbicides:** For industrial use, Dow Chemical Co. is now selling a nonselective herbicide, Bar-on. A liquid, containing 4 lbs./gal. of a chemical called erbon (chemically 2-(2,4,5-trichlorophenoxy) ethyl 2,2-dichloropropionate), it is readily emulsified. It is said to last a growing season. Dow says it's relatively nontoxic to animals, is noncorrosive to equipment.

American Chemical Paint Co. (Philadelphia) is, for the first time, selling aminotriazole as a herbicide. The chemical, tagged Amizol, has previously found limited use in the manufacture of photographic film. It has a herbicidal effect against quackgrass, nutgrass, and Canadian thistle.

**Homestyle Specialties:**

- Soft 'N White is a liquid laundry rinse, made by Soft 'N White, Inc. (Akron, O.). Claimed to make clothes softer and easier to iron than those washed without the chemical, it is also said to have an antistatic effect on synthetic fabrics. Soft 'N White, Inc., is associated with Mal Manufacturing Co., which produces several other washing specialties.

- Burnishine is a new French-fryer and broiler cleaner made by J. C. Paul & Co. (Skokie, Ill.). A can-packed cleaner (98¢), it is dissolved in water before use, is said to be nontoxic.

- Puritan Penetrant is a nonoil penetrant to loosen seized or corroded



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## SPECIALTIES . . .

parts. Olin Mathieson Chemical Corp. sells the compound, which is available in half-pint and pint sizes for retail sale, and gallon containers for shop use.

- Stix is an adhesive for adhering Formica, Micarta, Panelyte, etc. to wood without the use of heat or pressure. Maker is Adhesive Products Corp. (New York).

- Kitty Stop and Dog Stop are a pair of animal repellents now marketed by R. E. Ashwander & Co. (Lometa, Tex.) The compounds sell in 4-oz. bottles for \$1.

- Kip Antiseptic Oil, made by E. D. Bullard Co. (San Francisco) is now packaged in a 5.5 ounce aerosol can.

- Linko is the new name for the liquid detergent recently introduced by Linco Products Corp. (Chicago). Formerly called Winko, name was changed to avoid confusion with another product, and to give closer maker association.

**For Industry:** Newest specialties:

- For use with neoprene, Argus Chemical Corp. (Brooklyn) is now selling a new low temperature plasticizer, Drapex 3.2.

- Neoprene also figures in a new product of Rubber & Plastics Compound Co., Inc. (New York). Nerva-Kote TNE is the new neoprene-based coating offered by that firm—for lining ducts, tanks, etc. to prevent corrosion by alkalis, oils, and aliphatic solvents.

- Lagz is a protective coating for thermal insulation—a combination of neoprene and silicone rubbers with other resins. Said to have high mechanical strength, as well as corrosion resistance, it is offered as a coating for such insulation materials as magnesias (Grade 1), and cork or foamed plastics (Grade 2). It can be brushed or trowled on. Price: \$5/gal.; maker, West Chester Chemical Co. (West Chester, Pa.).

- Nox-Tarnish is a new packaging paper introduced by Daubert Chemical Co. (Chicago). Chemical treatment renders the paper capable of preventing silver tarnish.

- Pendent CA is a high molecular weight quaternary ammonium compound and fatty alcohols blend devised for preparation of "creme rinse" shampoos. M. H. Baker Co. (Minneapolis) sells it (Raymond Labs. makes it), says it also has uses as a textile and leather softener.

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## How to Diagnose Processes by Proxy

Electronic analogs to simulate unit processes are finding jobs in chemical companies. They can supplement or substitute for pilot plants.

At present, there are at least four firms making instruments for the purpose; price ranges from \$5,000 to \$200,000 depending on accuracy desired and complexity of unit.

Fact-loving engineers don't go in for soothsaying or crystal gazing. But they jump at the chance to check out a design hunch or study the performance of a process installation before the plant is built. Now they can do just that with the help of electronic analog computers that do everything but turn out pilot batches.

Analogues are not new to the chemical process industry. For many years they have been used to calculate heat transfer and flow, determine instrumentation requirements, and they are

the heart of many automatic control systems. But they are only beginning to realize their potential as process synthesizers in basic reaction studies.

**How They Work:** "Computer" doesn't accurately describe analog simulation equipment since it is used to duplicate process functions rather than to compute the results, as does a digital computer. Analogues are, in effect, pilot plants that resemble their prototypes only in behavior. Unlike models, which resemble their prototypes and operate by the same

processes, analogues employ components dissimilar to the actual equipment.

True computers perform calculations automatically, but do not necessarily go through the intermediate steps that in any way resemble the processes involved. Analogues, on the other hand, simultaneously and continuously parallel the actual performance at every stage.

**New Uses:** Though analogues have been used for some time in instrumentation studies by companies like Leeds & Northrup and Brown Instruments Division of Minneapolis-Honeywell Regulator Co. (CW, June 23, '51, p. 30), they have only scratched the surface of other process applications. Standard Oil of Indiana is readying an electronic analog computer in a new air-conditioned lab at Whiting, Ind. Scheduled to go into operation about



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**PRODUCTION . . . . .**

July 1, the equipment will be used to improve control characteristics of existing units, aid in designing projected refinery facilities. It is also expected to solve some types of engineering calculations that are not normally handled even on the electronic digital computers now available in the company.

Standard Oil of Ohio has also pur-

chased analog simulation equipment slated to go into operation sometime late in May or early June. Though specific applications have not been revealed by Sohio, they will probably be concerned principally with control and design of refinery processes.

Delving deeper into basic reaction studies, Technical Operations, Inc. (Arlington, Mass.) uses analog simula-

**WHY USE ANALOGS?**

**ANALOG PROCESS** simulators boast several advantages to back their bid for process applications. Some of the most obvious are:

- **Convenience.** Where prototypes do not exist, analogs predict performance, aid in making design decisions. And in the case of operating plants, they permit improvement to be studied and tested without interrupting the process.

- **Economy.** As a pilot plant bypass, the analog simulator offers flexibility far beyond that of small-scale plants. For one thing, the electronic components can duplicate precisely the operation of the full-size installation, thereby eliminating inaccuracies that often result when nonlinear processes are scaled up from models. Too, they can telescope time to duplicate in a few minutes reactions that would require hours in actual operation, or slow down processes so that rapid occurrences can be studied in slow motion.

- **Safety.** Engineers often need to know what to expect of equipment in the event of abnormal operation or failures. But subjecting operating equipment to emergency conditions could result in damage to machinery, injury to personnel. Analog, however, can take the risk of "blowing up" or "running away" without presenting the physical hazards.

- **Speed.** Aside from all its other unique advantages, the

analog simulator offers the one most important characteristic common to all computers—speed. In infrared spectrometry, for example, simultaneous equations that would require minutes or hours for manual calculations are solved in seconds by analogs that feed back automatic control.

- **Simplicity.** More and more, engineers are running up against process mechanics and phenomena so complex that a direct statistical or experimental approach is impossible. They are stymied by incomplete knowledge of pertinent parameters or the differential equations that govern the reactions. And in such cases the analog simplifies trial-and-error solutions too complex or too time consuming to be handled any other way.

Consider, for instance, how you would simulate a process about which you knew only the end results, the mathematical relations involved, and at most a part of the parameters. To duplicate the system on an analog, the measured parameters are set in, with reasonable values assumed for the unknowns. A trial run is made and the assumed values corrected until the indicated results correspond to those actually obtained. Once this balance is reached, you can consider the assumed values to be a true analogy and use the computer to predict effect of variations in the known parameters.

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# Dry Natural Gas

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### Data Proves That Silica Gel Is Best Drying Agent For Natural Gas

Field performance data shows that Davison Silica Gel is the superior drying agent for natural gas. No other drying agent offers all the advantages to be found in Davison Silica Gel.

- High capacity for moisture
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For detailed information and field performance data on the use of Davison Silica Gel for the drying of natural gas, write for Technical Bulletin No. 201.

Progress Through Chemistry

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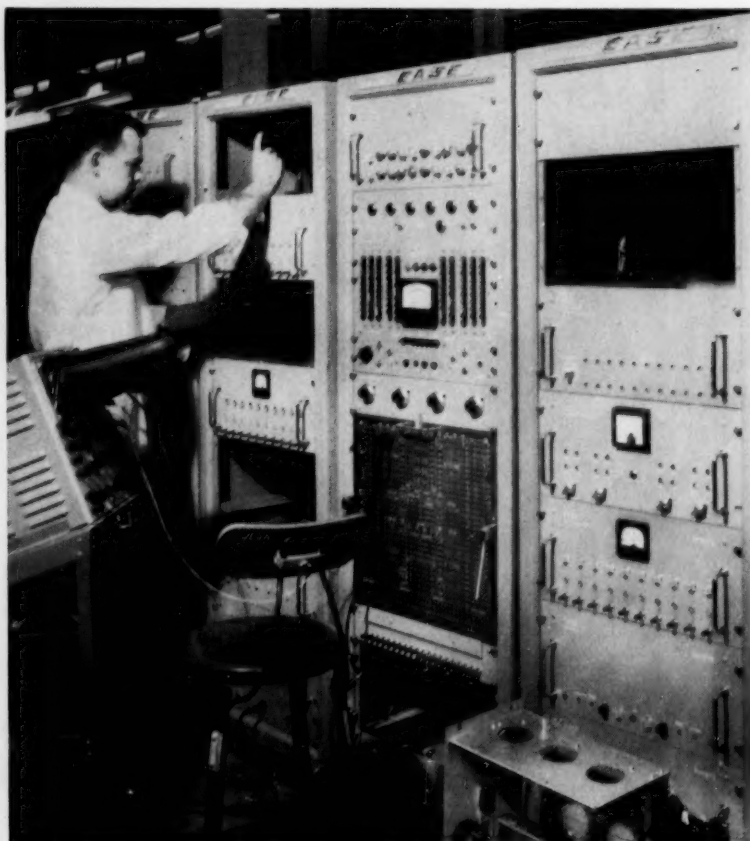
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PRODUCTION . . . . .



REFINERY-BOUND analog will simulate pilot plants, control loops.

tion to probe chemical kinetics. Typical of the process improvement made possible by analog analysis is the result TO obtained from studies of a two-component reaction. Initially, the two components were fed to a reactor in equal quantities, yielding about equal amounts of desired reaction product and by-product. Temperature conditions were fixed; feed concentration was the only permissible variable. Simulated reactor runs indicated that one feed component should be fed at only 1/10 to 1/20 the concentration of the other. When put into actual operation, the optimized feed ratio resulted in an increase to 90% yield of the desired product.

Dow Chemical Co. (Midland, Mich.) is also doing some intensive basic research with the aid of analogs.

Emphasizing the safety afforded by analog simulation, Westinghouse's Atomic Power Division (Pittsburgh, Pa.) has found it useful in atomic reactor control and system stability studies to set up parameters for chemi-

cal control, to evaluate effects of possible accidents. The nuclear power plant simulator solves simultaneously and continuously all of the linear and nonlinear differential equations, is especially useful in studying the transient response to load changes.

**Wide Choice:** Though the computer market is not crowded, it offers a wide selection of components and accessories to fit most process needs. Depending on your requirements, you can spend as little as \$5,000 for a modest general-purpose unit of 5% accuracy or as much as \$200,000 for a system with components accurate to 0.01%.

Designed for maximum flexibility and convenience, all the analog computers displayed at recent instrument shows on the East and West coasts are quite similar, construction-wise. They feature building-block assembly to simplify expansion by the addition of modular components, have instrument settings, controls and meters centrally located at a desk-type console. Potentiometers, amplifiers, servo re-



PRODUCT NEWS FROM **Pfizer**



check the  
performance  
of your present  
plasticizer against...

## PFIZER CITROFLEX\* (Esters of Citric Acid)

Now, you can get *odor free* CITROFLEX A-4 (acetyl tributyl citrate), a plasticizer with an extremely low order of toxicity. Accepted for use in food wrappings by the Food and Drug Administration, it is especially recommended for a wide list of applications where odor and toxicity are a problem. Some examples are *polyvinyl chloride films* used in packaging frozen and processed meats, poultry, baked goods, candy—and *polyvinyl chloride coatings* for cartons containing milk, cream, ice cream and cheese.

Also available are CITROFLEX A-2 (acetyl triethyl citrate), CITROFLEX 2 (triethyl citrate) and CITROFLEX 4 (tributyl citrate). Each has special properties of interest to processors of vinyls and cellulose.

For complete technical information and samples mail the coupon below.

**NEW!** Another addition  
to the Citroflex family.

### CITROFLEX A-8

(Acetyl Tri-2-ethylhexyl citrate)

- Low Volatility
- Good Low Temperature Flexibility

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Technical Bulletin #31 A
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# INDOPOL POLYBUTENES

## Uses

- As a component of
  - sealing compounds
  - insulation and sound deadening mastics
  - calking compounds
  - cements
  - pressure sensitive adhesives
- In the preparation of tracing paper
- As a dielectric for condensers
- As a lubricant in
  - aluminum drawing and rolling
  - special high temperature services

## Advantages

- High viscosity
- Compatible with vegetable oils, aliphatic and aromatic solvents and a wide variety of resins, waxes and pitches
- Minimum thermal decomposition residue
- Non-drying
- Color stable
- Non-migrating
- Low cost

## Properties

### INDOPOL POLYBUTENES

GRADE	L-10	L-50	L-100	H-35	H-50	H-100	H-300
Average Molecular wt.	330	420	470	660	700	780	940
Viscosity							
Saybolt seconds at 100°F	114	516	1040	7900	14000	44000	140000
at 210°F	40.6	66.5	93.8	375	540	1010	3000
Poises at 77°F	0.36	2.0	4.8	38	75	200	800
Gardner-Holdt at 77°F	A-1	H	R	Z-2	Z-4	Z-6	Z-9
Viscosity Index	100	105	102	—	—	—	—
Weight-Volume							
Specific Gravity 60°/60°F	.831	.847	.854	.871	.878	.881	.894
Pounds/gallon	6.92	7.04	7.11	7.25	7.31	7.34	7.44
Color							
N.P.A. or A.S.T.M.	1.5	1.5	1.5	1.5	1.5	1.5	<1
Flash (Tag), °F	230	235	245	280	295	360	475
Pour Point (ASTM) °F	-65	-35	-25	0	5	+20	+35
Iodine No.	53	46	43	36	34	33	32
Refractive index (20/D)	1.4655	1.4730	1.4759	1.4860	1.4886	1.4918	1.4955

## Information

For additional information on INDOPOL Polybutenes write for INDOPOL Technical Bulletin 12. Your request will be given prompt attention.

**INDOIL CHEMICAL COMPANY**



910 SOUTH MICHIGAN AVENUE, CHICAGO 80, ILLINOIS

## PRODUCTION . . . . .

solvers and multipliers, and function generators terminate in multi-outlet patch boards where they are conveniently interconnected by patch cords and plug-in jumpers. Some of the specially engineered refinements offered by the various systems:

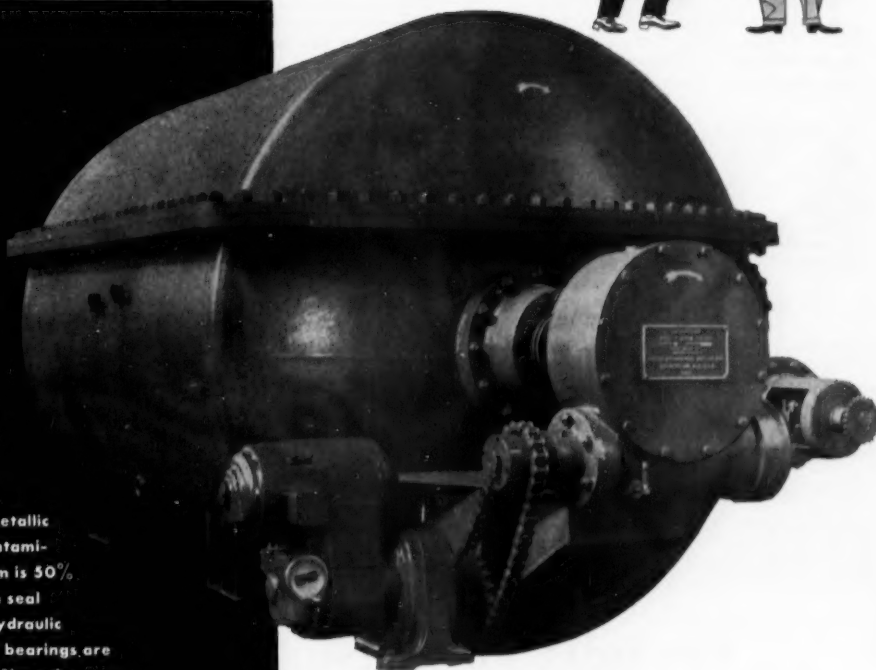
- EASE (Electronic Analog Simulation Equipment) manufactured by Berkeley Division of Beckman Instruments, Inc. (Richmond, Calif.) features push-button control, elapsed timer, and a digital voltmeter. Unlike the other systems, which were developed primarily for more exacting accuracy requirements, EASE cuts a few cost-saving corners on components for applications where 3% accuracy will suffice. The theory: higher accuracy is an extravagance in process work where problem information is usually accurate to only 10%.

- GEDA (Goodyear Electronic Differential Analyzer) manufactured by Goodyear Aircraft Corp. (Akron, O.) offers a problem patchboard laid out from an engineering standpoint rather than conventional grouping of similar components. In this way, says Goodyear, the engineer can "patch up" related elements to approximate more closely the flow sheet layout, instead of interconnecting them strictly by their mathematical relationship. Another deviation from standard practice is Goodyear's method of setting up large multipurpose systems. Instead of using permanent connections to one central patchboard, two or three basic control units are temporarily connected side by side. This arrangement is claimed to increase the flexibility of the installation by permitting the separate units to be used independently for other smaller problems.

- REAC (Reeves' Electronic Analog Computer) manufactured by Reeves Instrument Corp. (New York) is available in new sectionalized style of construction. It has a unique problem-checking feature that automatically checks operation of all components, patching of problem from diagram, and diagramming of problem from equations.

- PACE (Precision Analog Computer Equipment) made by Electronic Associates, Inc. (Long Branch, N.J.) incorporates many circuit refinements aimed at maximum accuracy and reliability of performance. Special feature is its 1,800-terminal patch bay constructed of metal to prevent terminal-

# A Perfect fit



Steel construction throughout, except for special G-B patented bronze locking strip between compartments. Caulking used is a non-metallic compound to prevent contamination of the slurry. Drum is 50% submerged and is held in seal against the valve by a hydraulic mechanism. Bronze lined bearings are lubricated by the slurry. Since the bearings are internal, the filter may be used up to 150 psig. and higher pressures without encountering stuffing box problems. The submergence may be less than 50% and a special sealed bearing used if the slurry is corrosive or abrasive.

## this Rotary Drum Pressure Filter is Typical

of the special designs G-B engineers develop to handle particular needs. The filter drum is 6'-0" in diameter by 8'-0" in length, and in this instance maintains a positive pressure of carbon dioxide on the filter cake to prevent the chemical reaction from reversing. Every detail has been worked out to fit the filter to the exact needs, rather than utilizing a "standard" filter and making the process conform to the filter.

*Process-minded G-B Engineers will work with you, too . . . without obligation!*

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**MANUFACTURING CO., INC.**  
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## effective heat seal bonding at low temperatures with ARCCO Emulsions, Solutions or Hot Melts

For example, do you want to eliminate a costly drying cycle? If so, your answer is an ARCCO hot melt. Do you want a non-tacky coating that you or your customer can subsequently heat seal? Again, the answer is an ARCCO heat seal emulsion or solution. These versatile com-

pounds can be heat sealed at temperatures from 220°F to 400°F, and may be used with conventional equipment.

ARCCO heat seal emulsions, solutions or hot melts open new possibilities in many fields for bonding paper, fabric, films, and foils used in the following end products:



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**Wearing Apparel —**  
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accessories  
**Surgical Goods**  
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**Candy and Gum**  
Wrappers  
**Potato Chip Bags**  
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Textile Labels  
Edge Sealing Tapes  
Garment Labels

and possibly your product.

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## PRODUCTION . . . . .

to-terminal leakage, housed in a thermostatically controlled oven to eliminate drift. PACE is available on a rental basis at EA's Computation Center (Princeton, N.J.).

**Second Sight:** More than just a window into process futures, analogs offer engineers a new approach to problems. Says Chalmer Jones, product line manager of Beckman's Berkeley Division: "There is no substitute for the intuitive knowledge of what is happening. Analog computers help the engineer to visualize his problem dimensionally. And for the first time, the engineer is on a par with the medical profession—he can bury his mistakes."

## EQUIPMENT . . . . .

**Process Watchdog:** An electronic indicating scanner has been developed by Fielden Instrument Division of Robertshaw-Fulton Controls Co. (Philadelphia) to keep a watchful eye on an unlimited number of process variables. Scanning control points at the rate of one per second, the instrument stops at any abnormal indication, actuates visual and/or audible alarms.

**Temperature Probes:** Yellow Springs Instrument Co., Inc. (Yellow Springs, O.) now offers six new probes for use with its Thermistor Tele-Thermometer. Specially designed for air, liquid immersion, flat surface, oral, and hypodermic temperature measurements, the probes feature fast response, small size.

**Packaged Exchanger:** Easy portability, says Falls Industries, Inc. (Solon, O.), makes its new Impervite Pumping-X-Changer ideal for pilot plants, other small-batch operations. Sold as a complete package, the units are produced from standard impervious graphite tube-and-shell heat exchangers with 917 sq. ft. of transfer surface, standard Impervite centrifugal pumps handling 200 gpm. at heads to 100 ft.

**Safety Suit:** To reduce the hazards to emergency workers handling corrosive or poisonous chemicals, Standard Safety Equipment Co. (Chicago) offers its Emergency Suit of StaSafe Gra-Lite fabric. The suit is inflated under slight positive pressure to prevent harmful fumes from entering.



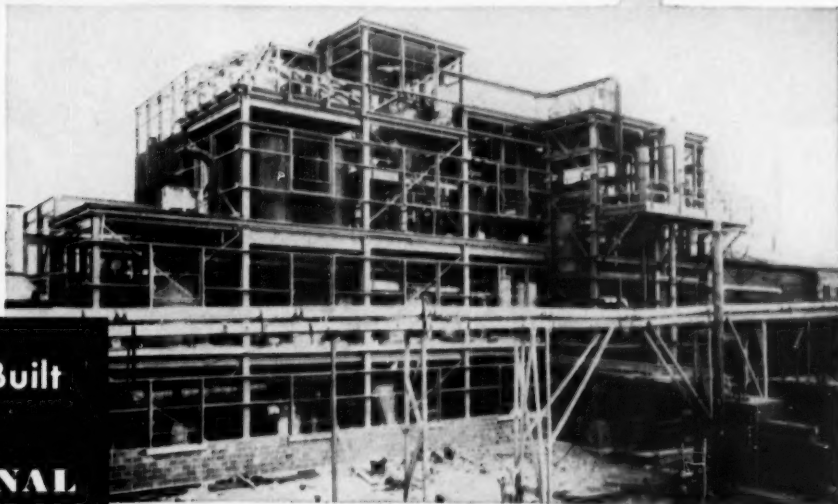
**MODERN**

**KOH**

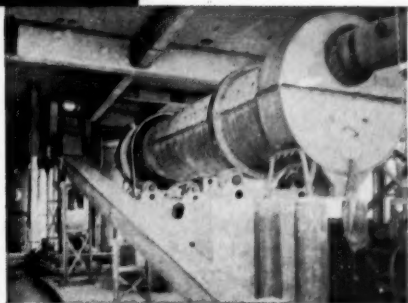
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April 16, 1955 • Chemical Week

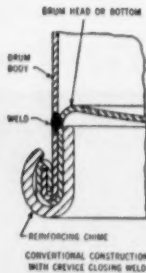
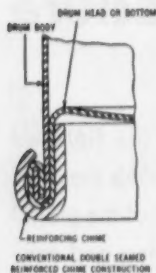
89

# Here are important features that mean big savings with USS Stainless Steel Drums and Pails



USS Stainless Steel Drums are available with durable rubber rolling hoops (as illustrated) that give extra protection to both the drum and its contents from bumps and shocks, prolong the life of the drum, make handling much easier and quieter, and keep the drum from marking and marring floors.

Our special patented construction seals off the inner crevice or opening that usually results from the conventional double seam construction. This prevents the contents of the drum from entering the double seam and being trapped within the crevice, making it easier to do a thorough cleaning job.



United States Steel Products fabricates stainless, galvanized, tinned, painted and decorated drums and pails . . . furnished in a wide range of capacities and with a variety of fittings and openings to meet every industrial need. If you would like any additional information on USS Steel Drums or Pails, just write to us at New York.

1. USS Stainless Drums and Pails give you many times the length of life of drums and pails made of conventional carbon steel because of greater tensile strength, extra durability.
2. USS Stainless Steel Drums and Pails are returnable, can make many trips, reducing considerably the unit cost of your shipping containers.
3. USS Stainless Steel Drums and Pails give complete product protection during shipping or storage . . . stops worry about contamination from rust, scale, grease or dirt.
4. USS Stainless Steel Drums and Pails stay clean and new looking inside and out. This is important in promoting customer confidence. And products that require sanitary containers are dependably safe in USS Stainless Steel Drums and Pails.

These containers are available in both tight and removable head construction.

*"It's Better to Ship in Steel"*

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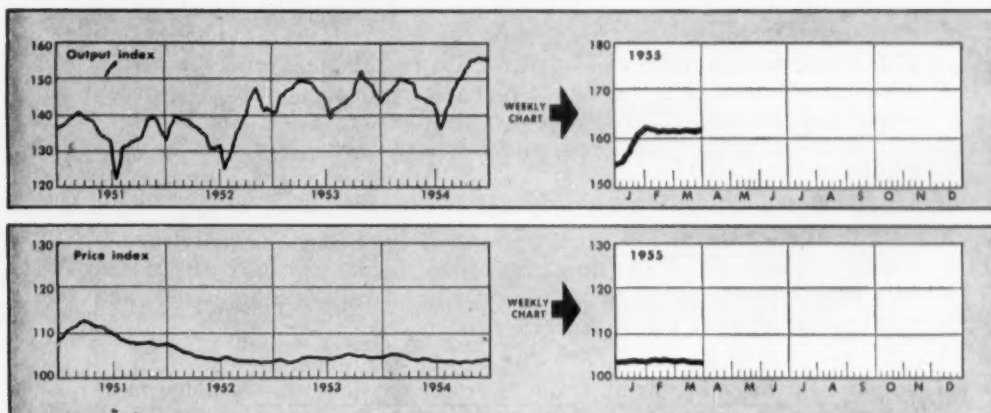
\*Expected Completion in April 1955

# USS STEEL DRUMS



UNITED STATES STEEL

# MARKETS . . . . .



## WEEKLY BUSINESS INDICATORS

CHEMICAL WEEK Output Index (1947-49=100)	159.8	160.7	146.5
CHEMICAL WEEK Wholesale Price Index (1947=100)	104.1	103.9	104.2
Stock Price Index of 13 Chemical Companies (Standard & Poor's Corp.)	379.0 (est.)	375.9	285.7

## MONTHLY INDICATORS—Employment (Thousands)

	Latest Week	Preceding Week	Year Ago
All Manufacturing	12,840	12,684	12,818
Nondurable Goods	5,398	5,360	5,388
Chemicals and Allied Products	542	529	539

## MARKET LETTER

You'll find few market observers who will dispute the now fairly obvious fact that there'll be a temporary ammonia surfeit in this country within a year or two (*CW*, Feb. 5, p. 75). Attendants at the American Chemical Society's national meeting in Cincinnati last week were given still another confirmation: an estimate that nitrogen, a basic ingredient of ammonia synthesis, could be produced at a fantastic 500-million-cu.-ft./day rate at refineries by the end of this year. The prediction came from Socony Vacuum Oil's Frank Ciapetta.

Several petroleum makers, as was pointed out earlier, are currently using refinery-by-product hydrogen to shift into relatively low cost ammonia production.

Right now, though, anhydrous ammonia movement to consumers appears somewhat spotty. While some suppliers report that they're selling all they can make, others aren't doing so well. Upcoming fertilizer demand within the next few weeks, however, should tighten the market considerably.

An effective market astringent is the continuing strike on the Louisville & Nashville Railroad, one of the South's principal chemical carriers. An imposing array of chemical makers depend on the system (*CW*, Apr. 2, p. 64), and while some consumers—especially of sulfuric acid—are going beyond the strikebound area for supplies, the stretch is costing more in freight charges.

Sulfuric output in the U.S. during '54, incidentally, just about matched the amount turned out the previous year, according to latest data out of Washington. The '53 vs '54 score: 14,002,534 tons, 14,000,519.

Last week it happened. Pinched copper consumers' pleas for more of the metal were heeded by the Office of Defense Mobilization, and so some 17,500 tons will be made available to industry for the April-June period. About 10,400 tons of it was slated for delivery to the government in the second quarter, and 7,100 tons represents a postponement—to March of next year—of delivery of copper which was to have been repaid by June 30, '55.

Copper sulfate production, inspired by the current high demand-low supply, is booming. The Bureau of Mines reports February output rose 33% over January (actually 48% greater on a daily average basis), and was the largest since a year ago.

On the other hand, trade in rosins continues quiet. Some marketers describe last week's business as exceptionally disappointing. A few, though, feel that things are about as good as can be expected at this season.

Consumers normally go slow in making purchases at the beginning of the new season in the gum industry, and "now is the time for caution" is the word. Reason, of course, is that many hope to pay less for material later in the year.

Despite current quiescence in wood rosin markets, the long-term outlook for tall oil rosin and fatty acids is growing rosier. Bolstering this prospect is an influx of capital in a swarm of tall oil plant developments. For example, these are tall oil plant developments coming up in 1956 or sooner: Crosby Chemicals (fractionation, Picayune, Miss.), Hercules Powder (rosin and fatty acids, Franklin, Va.), Union Bag & Paper (crude, refined, distilled and separated, Savannah, Ga.), West Virginia Pulp & Paper (fractionation, Charleston, S. C.).

A sure prop for more tall oil sales are brand-new separation methods yielding fatty acids and rosin from the sulfate pulp by-product. But month after month the oil comes from black liquor acidification. Last year, Southern pinewood sulfate pulp output alone hit an estimated 7.7 million tons, up from 7.5 million in '53. And count 60-70 lbs. of potential crude tall oil for each ton of this pulp.

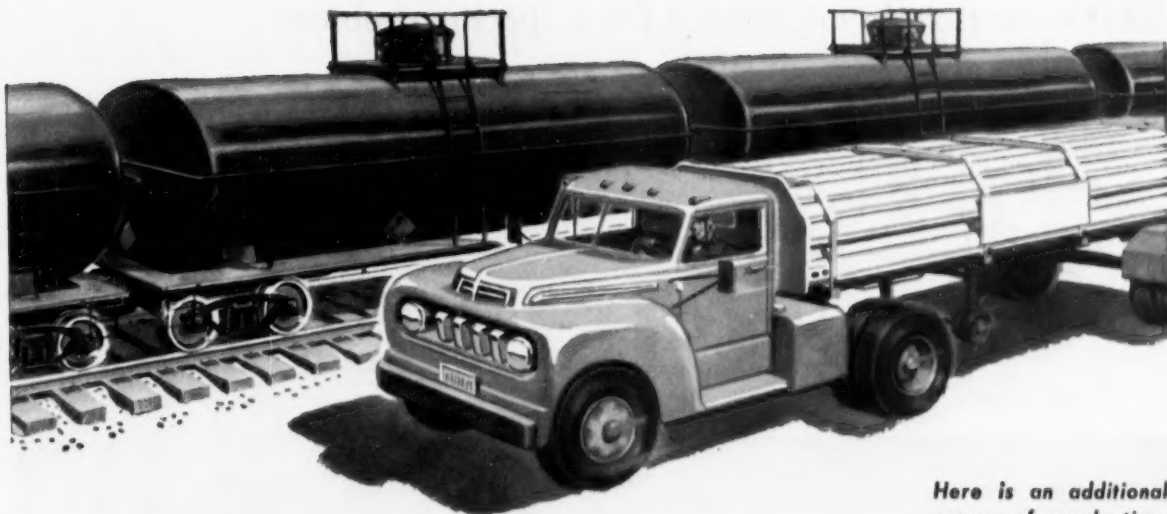
An answer is already in on the question whether TVA production of diammonium phosphate will balk entry of more private firms into the field (see p. 97). Two prospective producers of this phosphate: Ford Motor and Kaiser Steel. Within the last fortnight Kaiser has turned out 250 tons of the fertilizer material in an experimental run. Both companies will use by-product ammonia from coking facilities.

**SELECTED CHEMICAL MARKET PRICE CHANGES—Week ending April 11, 1955**

	Change	New Price		Change	New Price
<b>DOWN</b>					
Carnauba wax, No. 3, crude, Ceara, bgs., ton lots	\$ .01	\$ .62	Silver cyanide, fibre drums, 2,500-oz. lots, oz.	\$ .01125	\$ .78625
Gum turpentine, South, gal. (7.2 lbs.)	.0075	.5600	Silver nitrate, CP, crystals, bottles, 1,000-oz. lots, oz.	.01	.56875
Silver bullion, ingots, cases, Troy, oz.	.015	.870			

All prices per pound unless quantity is stated.





Here is an additional group of production-controlled, high-quality fluorides:

Ammonium Bifluoride  
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 Antimony Trifluoride  
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 Barium Fluoride  
 Bismuth Fluoride  
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 Boron Trifluoride  
 Complexes  
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 Copper Fluoborate  
 Fluoboric Acid  
 Fluorine Cells  
 Fluorinating Agents  
 Frosting Mixtures  
 Hydrofluoric Acid  
 Anhydrous  
 Hydrofluoric Acid  
 Aqueous  
 Hydrofluosilicic Acid  
 Lead Fluoborate  
 Metallic Fluoborates  
 Potassium Bifluoride  
 Potassium Chromium  
 Fluoride  
 Potassium Fluoborate  
 Potassium Fluoride  
 Potassium Titanium  
 Fluoride  
 Silico Fluorides  
 Sodium Fluoborate  
 Tin Fluoborate  
 Zinc Fluoborate  
 Zinc Fluoride

# HARSHAW FLUORIDES

## BORON TRIFLUORIDE HYDROFLUORIC ACID ANHYDROUS . . . AQUEOUS

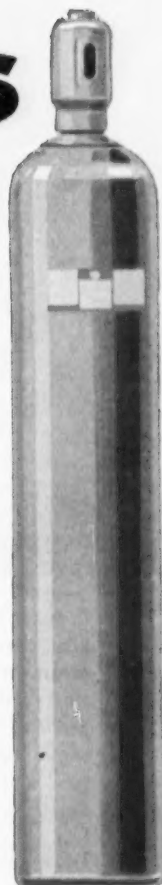
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If required, you are invited to draw on the knowledge and experience of our staff of technical specialists on fluorides. Broadly, we offer you the benefit of our accumulated experiences in engineering problems involving corrosion, safe handling and storage facilities.

**WRITE for Harshaw's 40-page Book on Hydrofluoric Acid Anhydrous. It provides helpful data for you if you now use HF or are considering its use.**

### THE HARSHAW CHEMICAL CO.

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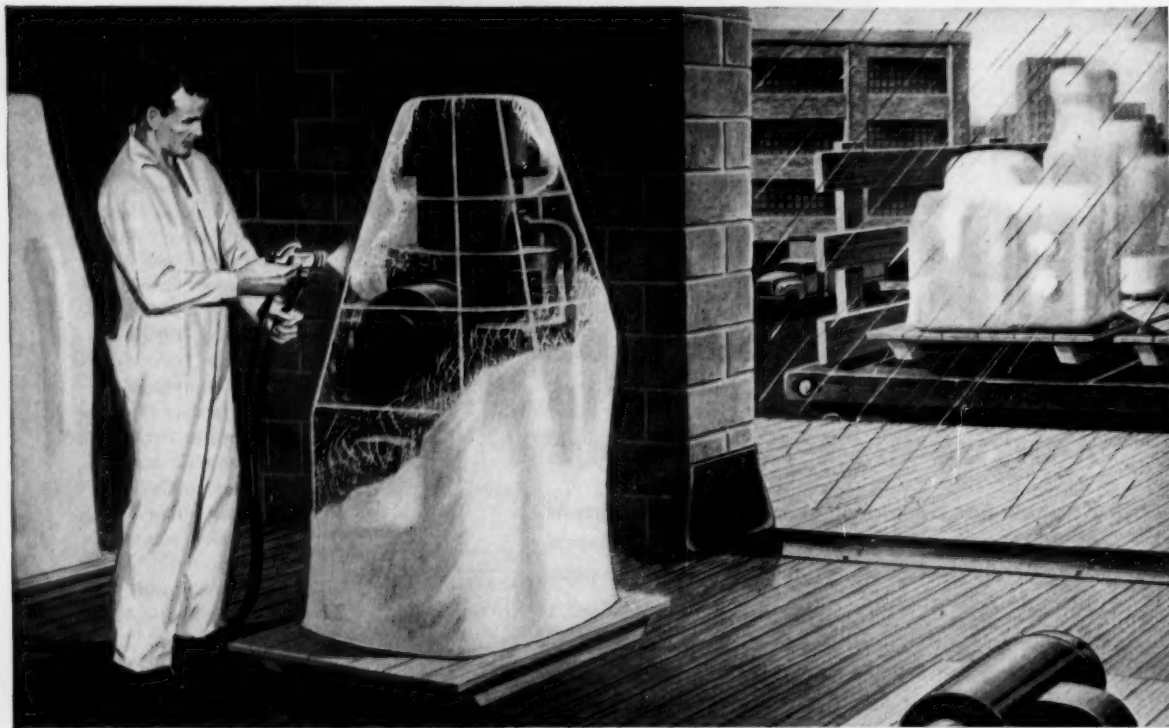
EXON: each resin engineered for a specific problem



# EXON 450

specifically for

# strip coatings



Using one resin instead of two spells **economy** for compounders of strippable vinyl coatings. New EXON 450 makes this possible. It simplifies compounding techniques because this one resin provides good solubility, film tensile strength and durability in the formulations based on it.

To assure product protection from dust, dirt, moisture, grease and weathering—both industry and government\* are making extensive use of spray-applied vinyl

wrappings made with EXON 450.

**Easy to use, easy to remove!** Strip coatings made from EXON 450 can be spray-applied from various solvent combinations and require no further maintenance. When the coating is stripped or peeled off, the product is left clean and ready for immediate use.

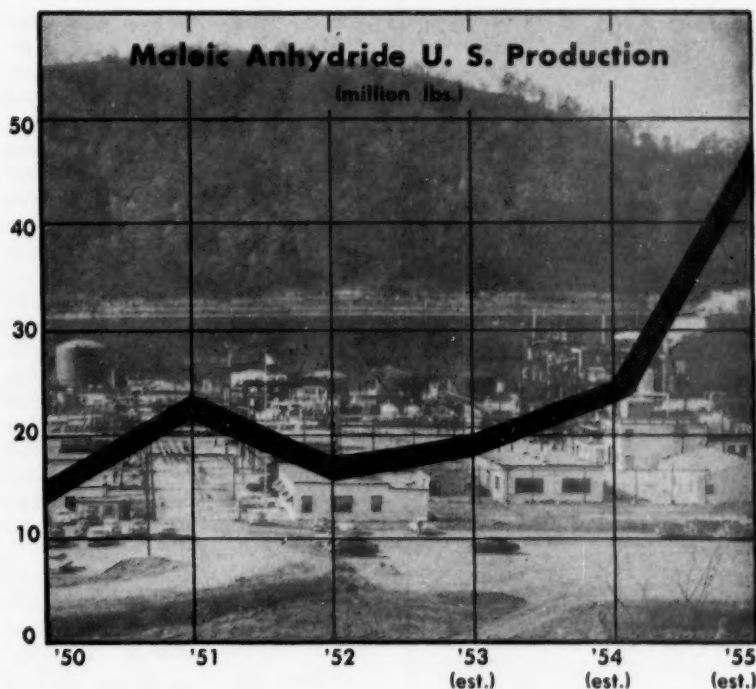
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MALEIC EXPANSION: Capacity is ready to meet this year's challenge.

## Maleic: On Deck, On Time

Maleic anhydride consumption, outpaced for years by total U.S. productive capacity, will this year begin the hoped-for surge that could, by '56, tax existing and upcoming installations.

Use will likely double in '55, and the reason is twofold: accelerated maleic take by long-hesitant reinforced-polyester resin outlets; adverse market conditions affecting some maleic competitors.

This year maleic anhydride will likely slip into high gear, finally begin to sweep toward a long-anticipated doubling in consumption. And to meet the expected run on supplies, maleic makers are whipping production schedules toward near-capacity levels. National Aniline, for example, with a new plant—estimated capacity: 10 million lbs./year—at Moundsville, W. Va. (see cut), is jumping its maleic producing potential to almost 20 million lbs., to forge ahead of pioneer Monsanto (with a current 12-14-million-lb. capability) as the major U.S. producer.

Later this year—probably in the early fall—Reichhold Chemicals will also more than double its 2-million-lb. maleic output (raising it to some 5 million) from its expanded Eliza-

beth, N.J., plant. These and stepped-up operations among other primarily captive usage producers will by year end put total maleic anhydride capacity close to 50 million lbs./year.

Compare that with the low-beat tempo of output over the past few years. Even during '51—the Korean-inflated peak year for most chemicals—maleic trotted along at less than a 24-million-lb. clip. By the following year the rate had slowed to a 17.8-million-lb. jog. No government statistics have been released on maleic since then, but it's generally conceded that this country produced about 20 million lbs. in '53 and some 5-10 million lbs. more than that last year.

Why the tremendous surge of use expectation? Two apparent reasons: belated fulfillment of some earlier

predictions concerning sure-fire maleic takers (e.g., polyester plastics); recent rapid development of some potentially large outlets.

Maleic anhydride, of course, is tied to the polyesters; in some cases maleic represents as much as 25% of the weight of the end product. This kinship, a few years ago, sparked many exuberant forecasts of an expanding market for maleic. Seldom has a group of chemical products been so overglamorized and so oversold as were the reinforced polyester resins. (CW, Oct. 31, '53, p. 61).

Excited proponents—in the period following World War II—conjured up visions of complete plastic homes, with plastic walls, tables, chairs; light-weight plastic automobiles by the millions; refrigerators, boats, trucks, bathtubs, TV sets—the list was endless. The enthusiasm was contagious, gave rise to predictions (repeated perennially), of surging maleic use.

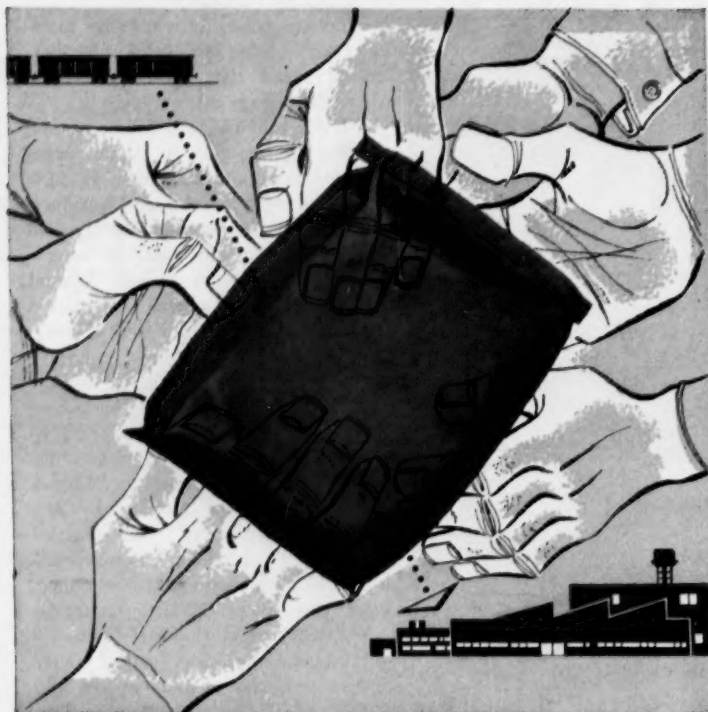
It's taken some time for the welter of new polyester ideas to evolve into a few solidly based maleic outlets. And this year will witness the first true upturning in consumption. For one, reinforced resin home furnishings, though not yet at the low-cost, high-volume fabrication stage, are doing well. And plastic bathtubs are currently being turned out (by Lunn Laminates, Huntington Station, N.Y.) at a near-20,000-units/year rate.

Not yet ready for real mass production, though, are the once highly publicized plastic-bodied sports cars (e.g., Chevrolet's Corvette, Kaiser's Darrin). However, complete cab and truck bodies—as well as other fabricated items, such as small boats, air-conditioning cabinets—show definite inclinations of moving up as big-time polyester (and, concomitantly, maleic anhydride) takers.

**Bigger Spread:** Still the biggest outlet for maleic this year, and probably for some years hence, are the versatile alkyd finishes. A good estimate of current maleic consumption in this outlet is 14-15 million lbs./year.

Use of maleic, though only a daub, compared with phthalic anhydride's consumption in alkyds (perhaps a near-150 million) lbs., will likely spread—not spectacularly, but steadily. This expectation, based on maleic's admittedly better impact-resistance properties, looks certain even under today's 6 or 7¢/lb. differ-





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## MARKETS . . . . .

ence in price of the two anhydrides.

Maleic, too, invariably gets a better play, despite its higher cost, when phthalic availability is pinched. And phthalic supplies for the past several weeks have been—and at the moment continue to be—somewhat less than adequate to promptly cover all consumers' demands. Thus more maleic calls will contribute to the current rising curve.

Another maleic use, in drying oils, particularly in the paint and varnish field, seems destined for a boost. Reason: market conditions affecting still-competitive tung oil (*CW*, April 9, p. 92). Maleic nudged into this outlet when Chinese tung supplies were cut off a few years ago, and processors have taken to maleic upgrading, or "maleinizing," oils since then.

These maleic oils are finding use in resin plasticizers in lacquers, as binders and dispersing agents in water paints, ink and linoleum; as rubber stabilizers, etc.

Less tung oil production due later this year, moreover, will probably mean an even deeper dipping into the more available maleic.

Greater, too, will be consumption in '55 in the agricultural chemical category. And that's a switch from earlier—rather gloomy—prognostications. When soil conditioner sales, after a jet-propelled start, atrophied for a variety of reasons (chiefly due to the influx of fast-profit promoters of shoddy products), maleic marketers were ready to mark down hopes for an expanded agricultural outlet.

But plant growth regulants, along with some new, promising pesticides,

### Maleic Anhydride End Use—1955

	million lbs.
Alkyd coating resins	14-15
Polyesters (casting, low-pressure laminates)	7-8
Drying oils	6-8
Ag chemicals (pesticides, plant growth regulants, soil conditioners, etc.)	5-6
Plasticizers	3-4
Paper sizing, rosin-maleic adducts	2-4
Other (pharmaceuticals, wetting agents, adhesives, etc.)	4



bid fair to fill the soil conditioner void. One such fungicide, captan, introduced commercially only last year, is being rated as a "hot" maleic outlet.

Although far afield from the farm, another relatively new development, use in fortified paper sizing and maleic rosin adducts, will reach out for some 2-4 million lbs. of anhydride. From a scratch start just a few years ago, maleic-paper size now seems to have a rosy future. Practically all paper mills in the country have looked at the maleic sizes, and enough have accepted to keep at least three major producers (Hercules, Cyanamid, Monsanto) busy filling orders.

These maleic anhydride consumers by no means complete the ever-growing roster; there are more in the works. Some, like a maleic-derived acrylic fiber, may one day soon burst forth. Then, say maleic enthusiasts, '55's expanded production won't be enough. They may be right.

## TVA Provokes Tiff

Chemical market economics may seem like an unusual subject for Congressional debate, but it's one that is making its rounds about Washington these days.

The specific commodity involved is diammonium phosphate (*CW Market-letter*, April 9). The argument is over the just-begun production of fertilizer-grade material by the Tennessee Valley Authority, and the planned marketing of the material in a 20-state area. The question: will the entry of TVA at this time promote wide-scale use of the material, or will it keep out companies that have been thinking of going into such production?

The high nutrient content (74%, when made from furnace phosphoric) and its relatively low shipping costs make it an especially attractive material for use in the Upper Midwest-Great Plains area and other fertilizer-using locations that are some distance from sources of basic fertilizer raw materials.

First official word of the TVA decision came in a 10-page memorandum, which outlined plans to produce some 5,000 tons of DAP in the 11 remaining weeks of its fiscal year. An estimated 20,000 tons would be produced in the full year ending June 30, '56.

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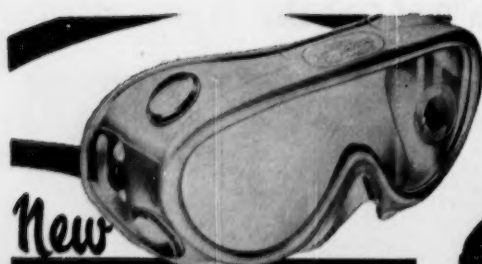
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## MARKETS . . . . .

\$110.49/ton, bagged, f.o.b. Sheffield, Ala., with some "slight deviations" for "services rendered." Such a price was well above its cost of production, and arbitrarily about \$10 below the amount at which it felt commercial producers could make a profit. Such a differential is "necessary to encourage distributors and farmers, who would not otherwise do so, to use this new product. TVA's \$120/ton commercial cost figure represents "preliminary estimates of production costs at favorable locations . . . [by] commercial producers with an economical source of ammonia and phosphoric acid."

The present industry producers of DAP are Colorado Iron & Fuel (CW Newsletter, Jan. 22; CW, Feb. 5, p. 50) and Farm Fertilizers, Inc., which both operate plants in Colorado, and Best Fertilizers, Inc., located in California. The Colorado producers both use furnace acid (from Monsanto); Best and TVA operate with wet-process acid. Probable present production of the private concerns: between 20,000 and 30,000 tons/year.

Some interested parties have raised their eyebrows rather high on TVA's \$120-cost-plus-profit estimates. According to one set of figures, material cost alone in Colorado runs to about this figure. (Of course, in distributing in nearby areas, there would be a considerable freight differential favoring the local producer over TVA.)

But the telling argument, as far as some observers are concerned, is over whether the TVA production bars other companies from entering the field. Replies TVA: No; there's a potential several-hundred-thousand ton/year market for companies entering the field. Total capacity now available: some 80,000 tons.

The answer—economics-wise—will probably come soon. One phosphoric producer reportedly is readying acid sale contracts with present by-product ammonium sulfate producers who could produce some 200,000 tons a year.

The answer—politics-wise—is twofold. There's an energetic move to get the White House to bar further TVA production as contrary to the Administration's get-the-government-out-of-business policy; there's a further move to bar such production by such tactics as attaching a rider to the TVA appropriations bill.



### *Putting a colorful flair in a highland fling*

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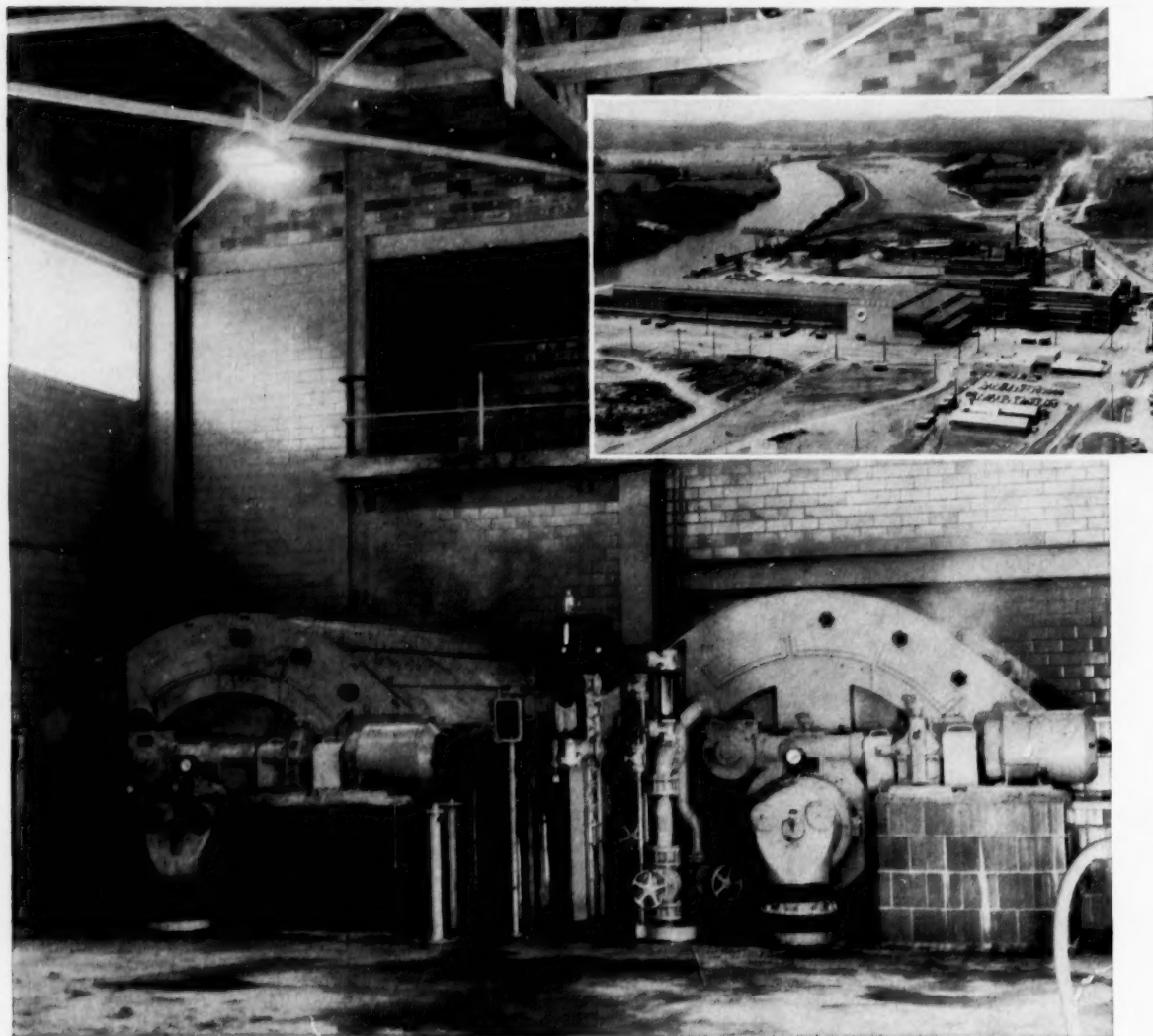
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Coatings for **Impco** bleach washers were made from **BAKELITE** Vinyl Resins by **Socony Paint Products Company**, Metuchen, N. J.

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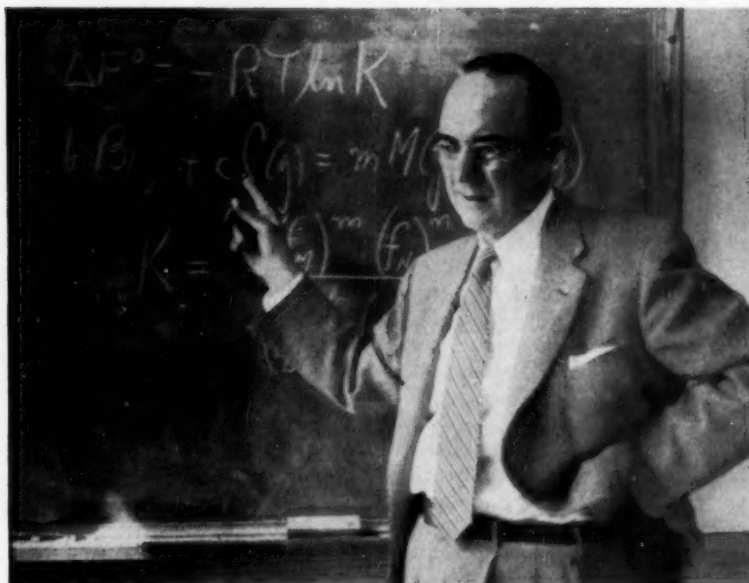
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CARNEGIE TECH'S ROSSINI: Small errors can have big consequences.

## Following in 44's Footsteps

Now getting under way at Carnegie Tech is MCA's long-term chemical characterization research project.

Patterned on American Petroleum Institute's project 44, the study will provide accurate physical and thermodynamic data, save research time and money for industry.

Writers don't have to develop a new vocabulary for each new story, and composers always have the same musical notes to work with. But the research chemist frequently finds that he is totally unfamiliar with many of the chemicals he tries to turn to rewarding use. And, more often than not, the physical and thermodynamic constants that characterize these substances are unrecorded in the literature or, if listed, are not sufficiently reliable or precise.

This situation usually calls for a departure from the main avenue of investigation while researchers elucidate the needed data. These excursions are costly, time-consuming and frustrating. More important, they're often unnecessary. In many cases, the sought-after data are in existence, although tucked unobtrusively away on a back shelf of a university or company library.

If comprehensive and thoroughly

accurate data of this kind were readily available to all who needed them, the resulting boon to research would be immeasurable. That's the thinking that has united chemical companies behind the creation of a fundamental study designed to produce an almanac of the physical and thermodynamic properties of chemicals.

This week the job of preparing this interminable volume got under way in newly completed quarters on the Pittsburgh, Pa., campus of Carnegie Institute of Technology. Financed by a \$40,000 grant from the Manufacturing Chemists' Assn., the fact-finding project is under the tutelage of Frederick Rossini, chairman of Tech's chemistry department and guiding spirit of the petroleum industry's program of fundamental research at the school.

Why is there now a need for a special data-producing group when the industry has long been able to get

along without one? The reason is threefold, according to Rossini. "Over the past several decades," he says, "our areas of interest have expanded greatly. Consequently, we need much more data than ever before in these areas. Second, entirely new areas of knowledge have opened up, calling for a wealth of new information. And last, the requirements of accuracy and precision in chemistry have increased tenfold, which means that we can no longer tolerate the old degree of uncertainty in the data we use."

From a very practical standpoint, a centralized cooperative program, sustained by a staff of experts, has considerable appeal. Duplication of effort will be minimized and companies are assured of receiving high-quality research for their investment.

Results of this research, moreover, may possess primary commercial value. Accurate data on heats of reaction, for example, are invaluable in gauging the promise of a new process. A mistake of three kilocalories will throw the reaction's calculated equilibrium constant off by a factor of 200.

**Hurts Both Ways:** Since equilibrium constant is used to calculate reaction yields, a 200-fold error could cause considerable head-scratching when chemists who anticipate a barrel-load of product get only a beakerful. No one designs a plant merely on the basis of a yield arrived at by mathematics. But this same error, on the negative side, might well cause a process development man to shelve a potentially profitable process.

Even though the MCA-supported project does not call for any laboratory experimentation, it will—emphasizes Rossini—be performing research. "When we took on this job," he explains, "we agreed that it was to be a research operation, not merely a case of collecting numbers."

What this means, simply, is that Rossini and his staff will be contributing original information to the body of scientific knowledge. They will determine physical properties on the basis of evidence called from a host of published sources, use these accurate values to deduce relationships between physical properties and chemical structure in different families of compounds. With such relationships, it is possible to predict properties (density,

boiling point, etc.) of substances that have never been prepared. They would also permit investigators to spot erroneous reported values.

Such empirical relationships, obviously, can only be as good as the data from which they are deduced. And that's why it's vitally important that the Carnegie probers be certain of the accuracy of the constants to which they give their seal of approval. It will be their responsibility, for instance, to determine the real boiling point of a compound possessing five or six listed boiling points, each reported by a different investigator.

Equations relating properties of chemicals may simplify this kind of detective work. But the origin of the data in question often is the only clue to its accuracy. "We base our conclusions on what we know of how a particular value was obtained: what instruments were used, how they were calibrated, the kind of temperature control maintained during the experiment.

"But of equal importance is the reputation of the scientist who did the work in question. Some men," he avers, "are thoroughly reliable and we have learned that the results they report are sure to be of top quality. Others we find do a uniformly unsatisfactory job for our purposes and we can safely reject their data when we come across them in the literature.

The man who gives us headaches is the fellow who does a top-notch job one time and a sloppy one the next; he's the fellow who puts our powers of deduction to the test."

**Familiar Story:** Results of the MCA-sponsored sleuthing probably will be made available in the form of data sheets to member companies and academic institutions. This will be a familiar story to the petrochemical people who, for the past 12 years, have regularly received data pages from American Petroleum Institute's research project 44, which Rossini also guides. The latest collective volume of data from this effort, published in 1953, contains 1,050 pages.

The success of API project 44 was responsible, in large measure, for the birth of the new chemical program and the decision to trust it to Rossini's care. Therefore, it's not surprising that, in all of its proposed features, the MCA probe is taking the same shape as the former. Like API project 44, the chemical study will constantly police the whole mass of data it develops, update any value that may be improved by new information.

This high degree of internal consistency is one of the most valuable features of project 44's published data and a principal point of departure from previous compendia. The International Critical Tables (published in

the 1930's), for example, are of little use today because the values they list have not been brought up to date.

Four full-time staffers and several part-time workers, led by chief investigator James C. M. Li\*, are getting the MCA effort into motion. Halogen-, phosphorus-, and nitrogen-containing chemicals comprise their first targets.

Unassuming by nature, Rossini does not predict glowing discoveries for the newly launched project. But he makes no secret of his satisfaction at seeing chemical companies join in uncovering fundamental information that will benefit not only themselves but also scientists in all walks of chemical research.

## Movement for Accord

One international headache that now shows signs of waning is the situation with respect to chemical patents. Very few foreign countries equal the U.S. in the patent protection afforded on chemical substances and processes—a fact learned the hard way by many a domestic firm bent on patenting its wares abroad. But new thinking in diplomatic echelons may eventually eliminate this inequity.

Right now, Switzerland and Canada are considering changes in their patent laws to bring them more in line with those in force here. And next week, the patent chiefs of 50 non-Communist nations meet in Berne, Switzerland, to prepare an agenda for a future diplomatic conference. Its stated goal: to provide uniformity in patent and trademark laws.

The latter confab, latest revival of the Convention of 1883—first major attempt to secure patent accord—will be held in Lisbon, Portugal, in late '56 or early '57.

Behind many of the recommendations submitted at the pending convention will be the International Assn. for the Protection of Industrial Property, an organization of patent attorneys and industrialists, many of them affiliated with chemical companies.

The principal countries of the world (exclusive of Communist-controlled areas—which offer virtually no patent advantages to foreigners) fit into three broad categories.

In addition to the U.S., countries like Australia, Belgium, Cuba, Great Britain, New Zealand, Union of South

\* By coincidence, project 44's chief investigator is Kun Li.



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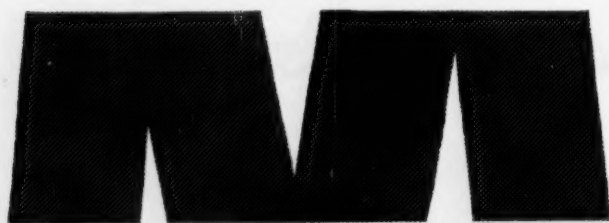
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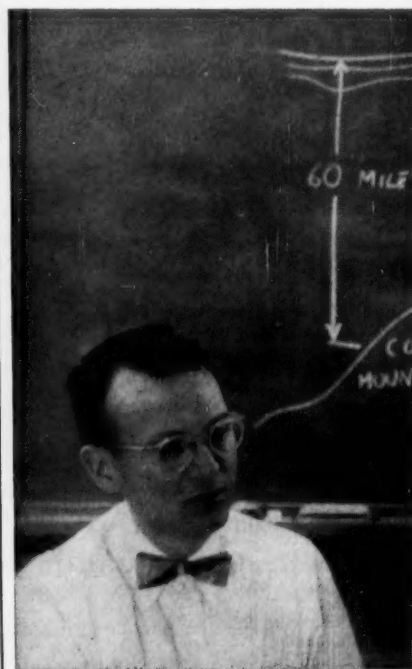
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## RESEARCH . . . . .

Africa and Greece place no restriction upon what may be patented. Patents may be obtained on chemicals, medicines, pharmaceuticals and foods, as well as their manufacturing processes.

In Argentina, Canada, Denmark, France, Italy and Mexico, however, new chemical products used in industry are patentable, but the laws contain a prohibition against the issuance of patents covering medicines, pharmaceuticals and/or foods.

The largest group contains countries that prohibit the issue of patents for any chemical substances, including medicines, pharmaceuticals, and foods. They include Austria, Brazil, Eire, Finland, Germany, Holland, India, Japan, Luxembourg, Norway, Portugal, Spain, Sweden, Switzerland.



## Superpressure

GARNET SYNTHESIS, first such disclosure since diamond-making (CW, Feb. 26, p. 62), was reported last week by General Electric. Robert Wentorf (r) made the mineral by subjecting hornblende to a pressure of 375,000 psi. at 2200



.....

All in all, it's not a bright picture. But there's new hope that groups like IAPIP (and its U.S. arm, the International Patent and Trade Mark Assn.) can bring about wider acceptance of the principle that chemicals are patentable.

### Toxicant Grubs

Newly emerged from their developmental cocoons, these compounds are trying for a range of toxicant uses:

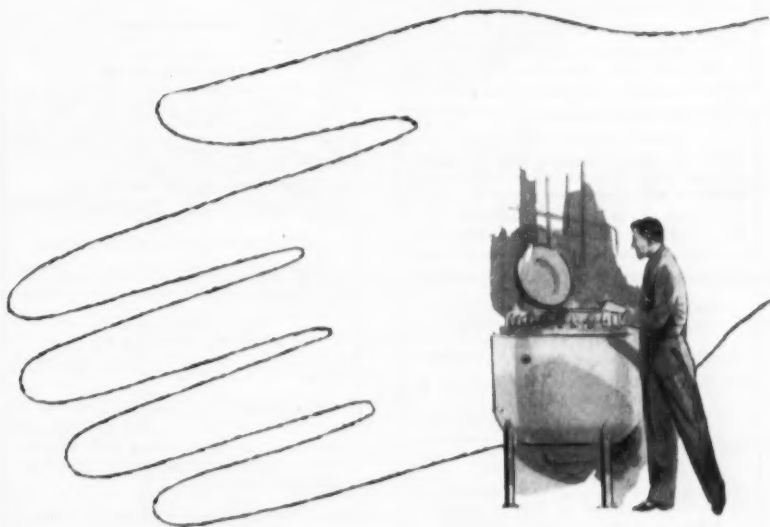
- An insecticidal dust consisting of 2,4-dinitrothiophene, diluted 1:100 with pyrophyllite, reportedly gives a 100% kill of fruit flies in 30 minutes. The insect-killing efficacy of nitrothiophenes is enhanced by piperonyl butoxide, propoxide, and butylcarbinol oxide. Details are contained in U.S.



### Encore

F. There's no immediate commercial value to the garnet synthesis. But the superpressure techniques being pioneered by GE's Wentorf, Tracy Hall (*left*) and others are showing the way to a family of unusual new synthetics.

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## RESEARCH . . . . .

Pat. 2,691,616 awarded to Eastman Kodak Co.

- According to British patent 701,111, to J. R. Geigy, substituted 4-hydroxycoumarins (made by heating substituted benzylidene acetones with 4-hydroxycoumarin) are potentially valuable rodenticides.

- For soil fumigation, 1-chloro-3-bromo-1-propene is worth watching. Covered by U.S. Pat. 2,695,859, to Shell Development Co., the compound is made by reaction of 1,3-dichloro-1-propane with an alkali bromide. It's applied by a water-emulsion spray comprised of fumigant, a miscible solvent (e.g., kerosene, xylene, carbon tetrachloride), and 2-3% cationic emulsifier.

- Various fungal diseases are vulnerable to certain mono-, di- and trichloro- $\beta$ -naphthols and corresponding naphthyloxy-n-carboxylic acids, according to researchers at University of Bristol (England). Found to be most effective: the 1,3,4-trichloro; 1,3-dichloro; 1,4-dichloro; and 3,4-dichloro compounds, in that order.

- Latest word in cellulosic preservatives is a copper-3-phenylsalicylate-ammonia addition product newly patented (U.S. 2,695,858) by Dow Chemical Co. Textiles, paper and wood require 0.5-3% of the chemical for mould protection.

### Comers?

Included among the new chemicals and instruments unveiled at the American Chemical Society meeting in Cincinnati:

- Fluoroalcohol diester lubricants, stable at temperatures up to 500 F, were described by the Naval Research Laboratory's (Washington, D.C.) H. Ravner, head of oxidative studies in the lab's surface chemistry branch. Said to be comparable to petroleum oils in lubricating ability, the fluoroesters possess the advantage of relatively low flammability. Possible applications: in aircraft gas turbine engines, high-temperature electric motors and generators, submarines (the new lubes are denser than sea water, won't form position-revealing oil slicks). High viscosity at low temperatures is expected to limit use of the compounds in aircraft hydraulic systems.

- Cold sterilization of food and drugs is said to be simplified by a new



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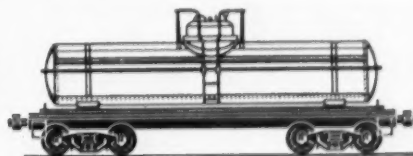
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radiation detector developed by Ernest Henley and David Richmond, of Columbia University (New York). The dosimeter consists of cellophane impregnated with a dyestuff that undergoes proportional shade changes in the radiation range of 100,000 to 10 million roentgen units—the span used for radiation sterilization. Strictly for use at high radiation levels, the colored cellophane is not sufficiently sensitive for use as a radiation warning device.

• A series of new bis-ammonium salts was disclosed by Irwin, Neisler & Co. researchers to be promising hypertension drugs. In tests with

laboratory animals, the compounds reportedly lowered blood pressure with no apparent ill effect on nerve centers responsible for headache, nausea and constipation.

• **Virus Checkers:** Recent research by University of Wisconsin biochemists Maurice Green and Mark Stahman reveals that polylysine and polyvinylamine inhibit the production of influenza-B virus in chick embryos. Polylysine, about one-fifth as toxic as polyvinylamine to the embryos, is probably metabolized to nontoxic lysine.

**Iodimetry Aid:** A dry white organic powder called Thyodene, newly available from Fisher Scientific Co. (Pittsburgh), is reportedly superior to starch as an iodine indicator. It's supplied ready-to-use, doesn't deteriorate or ferment on storage, yields sensitive endpoints. Price: \$5/4 oz. bottle; \$18/lb.

• **Mobile Bench:** Attachable to any lab bench (by means of a guide rail), a new mobile unit called Rolla-bench adds working space where it's needed. Manufacturer: Palo Laboratories, Inc. (New York).

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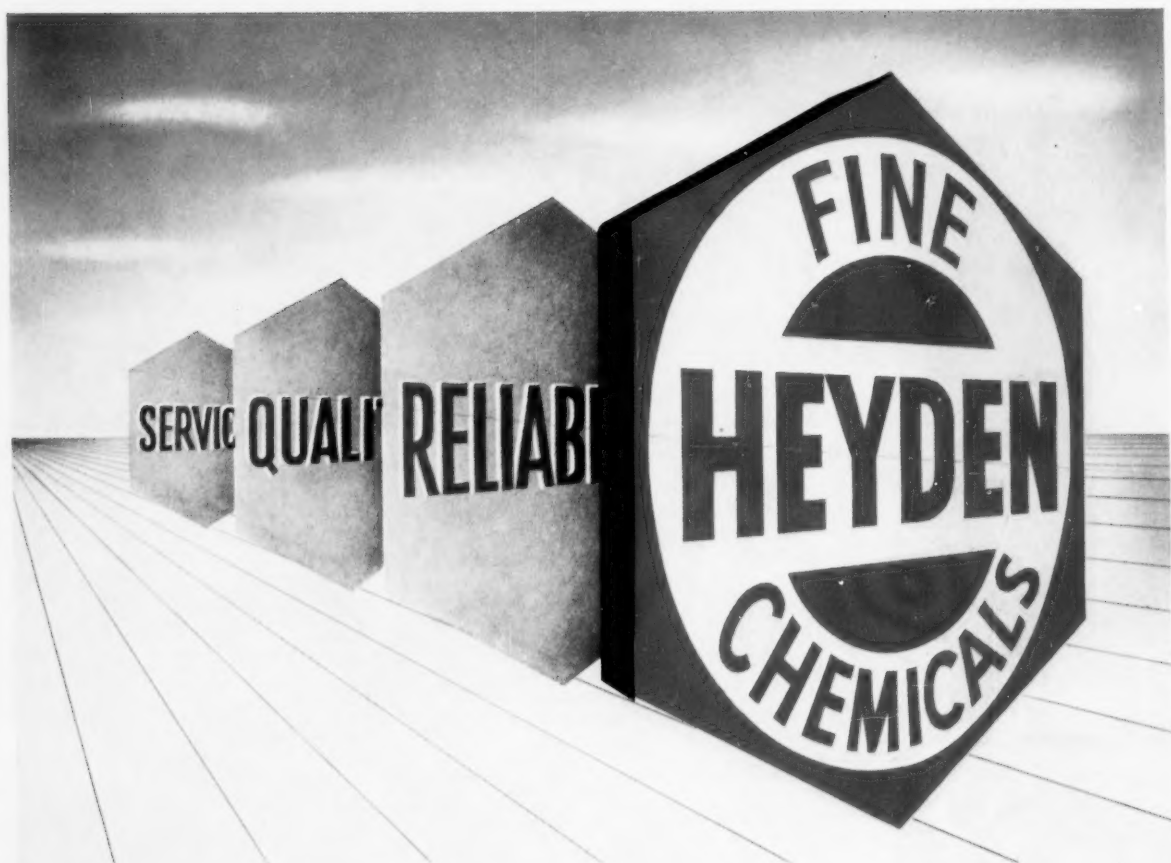
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